The Department of Defense

Small Business Technology Transfer (STTR)

FY 2001

Program Solicitation
Closing Date: 11 April 2001

DoD Departments/Agencies:

Department of the Army

Department of the Navy

Department of the Air Force

Ballistic Missile Defense Organization

PROGRAM SOLICITATION

Number 2001

Small Business Technology Transfer (STTR) Program

IMPORTANT

The DoD updates its SBIR/STTR Mailing list annually. To remain on the mailing list or to be added to the list, send in the Mailing List form (Reference I), found at the back of this solicitation or complete the electronic form at http://www.teltech.com/sbir/form.html. Failure to send in the form annually will result in removal of your name from the mailing list.

If you have questions about the Defense Department's STTR program, please call the SBIR/STTR Help Desk at (800) 382-4634, or see the DoD SBIR/STTR Home Page, at http://www.acq.osd.mil/sadbu/sbir.

U.S. Department of Defense
STTR Program Office
Washington, DC 20301

January 2, 2001:	Solicitation issued for public release
March 1, 2001:	DoD begins accepting proposals
April 11, 2001:	Deadline for receipt of proposals at the DoD Components by 2:00 p.m. local time

ACQUISITION AND
TECHNOLOGY

OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON
WASHINGTON DC 20301-3000

IMPORTANT NEW INFORMATION ABOUT THE DOD STTR PROGRAM

1. **The DoD SBIR/STTR Help Desk** can address your questions about this solicitation, the proposal preparation process, contract negotiations, getting paid, government accounting requirements, intellectual property protection, the Fast Track, obtaining outside financing, and other program-related areas. You may contact the Help Desk by:

   Phone: 800-382-4634 (8AM to 8PM EST)
   Fax: 800-462-4128
   Email: SBIRHELP@teltech.com

2. **The DoD SBIR/STTR Web Site (http://www.acq.osd.mil/sadbu/sbir)** offers electronic access to many important resources for STTR participants, such as the initial public release of each STTR solicitation, sample STTR proposals, model STTR contracts, links to the Component STTR programs within DoD, answers to commonly-asked questions about STTR contracting, descriptive data on the STTR program, and the latest program updates.

3. **Starting with the last solicitation (Number 2000-- March 1, 2000), your STTR Proposal Cover Sheet (formerly, "Appendix A and B") and Company Commercialization Report must be submitted electronically through the Web Site www.dodsbir.net/submission,** as described in Sections 3.4.b and 3.4.n .

4. **DoD has adopted commercialization of SBIR/STTR technology (in military and/or private sector markets) as a critical measure of performance** for both the DoD STTR program and the companies that participate in the program. This new policy is reflected in Sections 3.4h and 3.6 of this solicitation (Commercialization Strategy); Section 3.4n (Company Commercialization Report on Prior SBIR Awards); Section 4.4 (Assessing Commercial Potential of Proposals); and Section 5.4 (Commercialization Report Updates).

5. **Under DoD's "Fast Track" policy (section 4.5), STTR projects that attract some matching cash from an outside investor for the Phase II effort have a much higher chance of Phase II award --** see www.acq.osd.mil/sadbu/sbir/fsttrack.html#results. Fast Track projects also receive expedited processing and interim funding between Phases I and II.

6. **You may contact the DoD authors of solicitation topics to ask questions about the topics** before you submit a proposal. Procedures for doing so are discussed in Section 1.5(c) of this solicitation. Please note that you may talk by telephone with a topic author to ask such questions only between January 2, when this solicitation was publicly released, and March 1, when DoD begins accepting proposals. At other times, you may submit written questions as described in Section 1.5c. **A**

7. **An STTR proposal that meets the goals of a solicitation topic but does not use the exact approach specified in the topic will still be considered**. For further information on this new DoD policy, see Section 4.1 of this solicitation.

8. **A number of the Army, Navy, and Air Force topics are supported by a DoD acquisition program (e.g., New Attack Submarine, Abrams Tank),** as noted in the text of the topic. These acquisition programs are potentially important end customers for innovative new products resulting from SBIR projects. Information on how to contact these programs is posted on the DoD SBIR/STTR Web Site at www.acq.osd.mil/sadbu/sbir/acqproj/liaisons.htm.

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DOD PROGRAM SOLICITATION FOR SMALL BUSINESS TECHNOLOGY TRANSFER

1.0 PROGRAM DESCRIPTION

1.1 Introduction

The Army, Navy, Air Force, and Ballistic Missile Defense Organization (BMDO), hereafter referred to as DoD Components, invite small business firms and research institutions to jointly submit proposals under this solicitation for the Small Business Technology Transfer (STTR) program. The STTR Program is a pilot program under which awards are made to small business concerns for cooperative research and development, conducted jointly by a small business and a research institution, through a uniform process having three phases. STTR, although modeled substantially on the Small Business Innovation Research (SBIR) Program, is a separate program and is separately financed. Subject to availability of funds, DoD Components will support high quality cooperative research and development proposals of innovative concepts to solve the listed defense-related scientific or engineering problems, especially those concepts that also have high potential for commercialization in the private sector.

The STTR Program is designed to provide a strong incentive for small companies and researchers at research institutions, i.e., non-profit research institutions, contractor-operated federally funded research and development centers (FFRDCs), and universities, to work together as a team to move ideas from the research institution to the marketplace, to foster high-tech economic development, and to address the technological needs of our armed forces. (See Reference H)

Partnerships between small businesses and Historically Black Colleges or Universities (HBCUs) or Minority Institutions (MIs) are encouraged, although no special preference will be given to STTR proposals from such offerors.

The Federal STTR Program is mandated by Public Law 102-564. The basic design of the DoD STTR Program is in accordance with the Small Business Administration (SBA) STTR Policy Directive of 1993. The DoD Program presented in this solicitation strives to encourage scientific and technical innovation in areas specifically identified by DoD Components. The guidelines presented in this solicitation incorporate and exploit the flexibility of the SBA Policy Directive to encourage proposals based on scientific and technical approaches most likely to yield results important to DoD and the private sector.

1.2 Three Phase Program

This program solicitation is issued pursuant to the Small Business Research and Development Enhancement Act of 1992, PL 102-564. Phase I is to determine the scientific, technical and commercial merit and feasibility of the proposed cooperative effort and the quality of performance of the small business concern with a relatively small investment before consideration of future DoD support in Phase II. Several different proposed solutions to a given topic may be funded. Proposals will be evaluated on a competitive basis giving primary consideration to the scientific and technical merit of the proposal along with its potential for commercialization. Phase I awards are typically $60,000 to $100,000 in size over a period not to exceed one year.

Subsequent Phase II awards will be made to firms on the basis of results of their Phase I effort and the scientific, technical merit and commercial potential of their Phase II proposal. Phase II awards are typically $400,000 to $500,000 in size over a period generally not to exceed 24 months (subject to negotiation). Phase II is the principal research or research and development effort and is expected to produce a well-defined deliverable product or process.

Under Phase III, the small business is expected to use non-federal capital to pursue private sector applications of the research or development. Also, under Phase III, federal agencies may award non-STTR funded follow-on contracts for products or processes which meet the mission needs of those agencies.

DoD is not obligated to make any awards under either Phase I, II, or III. DoD is not responsible for any monies expended by the proposer before award of any contract.

1.3 Proposer Eligibility and Limitation

Each proposer must qualify as a small business for research or research and development purposes as defined in Section 2.3 and certify to this on the Cover Sheet of the proposal. In addition, a minimum of 40 percent of each STTR project must be carried out by the small business concern and a minimum of 30 percent of the effort performed by the research institution, as defined in Section 2.4. The percent of work is usually measured by both direct and indirect costs; however, proposers should verify how it will be measured with their DoD contracting officer during contract negotiations.

A small business concern must negotiate a written agreement between the small business and the research institution allocating intellectual property rights and rights to carry out follow-on research, development, or commercialization (see Reference C).

At the time of award of a Phase I or Phase II contract, the small business concern must have at least one employee in a management position whose primary employment is with the small business and who is not also employed by the research institution. Primary employment means that more than one half of the employee's time is spent with the small business.

For both Phase I and Phase II, the research or research and development work must be performed by the small business concern and research institution in the United States. "United States" means the fifty states, the Territories and possessions of the United States, the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands, the Trust Territory of the Pacific Islands, and the District of Columbia.

Joint ventures and limited partnerships are permitted for the small business portion, provided that the entity created qualifies as a small business in accordance with the Small Business Act, 15 USC 631, and the definition included in Section 2.3.

1.4 Conflicts of Interest

Awards made to firms owned by or employing current or previous Federal Government employees could create conflicts of interest for those employees in violation of 18 USC and 10 USC 2397. Such proposers should contact the cognizant Ethics Counselor from the employees' Government agency for further guidance.

1.5 Questions about STTR and Solicitation Topics

a. General Questions/Information. The DoD SBIR/STTR Help Desk is prepared to address general questions about this solicitation, the proposal preparation process, contract negotiation, payment vouchers, Government accounting requirements, intellectual property protection, the Fast Track, financing strategies, and other program-related areas. The Help Desk may be contacted by:

Phone: 800-382-4634 (8AM to 8PM EST)
Fax: 800-462-4128
Email: SBIRHELP@teltech.com

The DoD SBIR/STTR Home Page offers electronic access to SBIR and STTR solicitations, answers to commonly asked questions, sample proposals, model contracts, abstracts of ongoing SBIR and STTR projects, the latest updates on the SBIR and STTR programs, hyperlinks to sources of business assistance and financing, and other useful information.

DOD SBIR/STTR HOME PAGE:
http://www.acq.osd.mil/sadbu/sbir

b. General Questions About a DoD Component. General questions pertaining to a particular DoD Component (Army, Navy, Air Force, etc) should be submitted in accordance with the instructions given at the beginning of that Component's topics, in Section 8.0 of this solicitation.

c. Technical Questions about Solicitation Topics. On January 2, 2001, this solicitation was issued for public release on the DoD SBIR/STTR Home Page (http://www.acq.osd.mil/sadbu/sbir), along with the names of the topic authors, their phone numbers and other contact information, giving proposers an opportunity to ask technical questions about specific solicitation topics.

Once DoD begins accepting proposals on March 1, 2001, questions will no longer be accepted directly by the topic authors. Proposers can however submit questions through the SITIS (SBIR/STTR Interactive Topic Information System) website. All questions and answers are posted in SITIS. Proposers may submit questions via Internet (linked from the DoD SBIR/STTR Home Page), e-mail, fax, mail, or telephone to:

Defense Technical Information Center
MATRIS Office, DTIC-AM
ATTN: SITIS Coordinator
NAS North Island, Box 357011
San Diego, CA 92135-7011
Phone: (619) 545-7529
Fax: (619) 545-0019
E-mail: sbir@dticam.dtic.mil
WWW: http://dticam.dtic.mil/sttr/

The SITIS service for this solicitation will begin posting questions and answers on or about January 17, 2001, and will close to new questions on March 30, 2001. Answers will also be e-mailed or faxed directly to the inquirer if an e-mail address or fax number is provided. Answers are generally available within seven working days of question submission.

All proposers are advised to monitor SITIS during the solicitation period for questions and answers, changes, and other information relevant to their chosen topics.

1.6 Requests for Copies of DoD STTR Solicitation

To remain on the DoD Mailing list for the SBIR and STTR solicitations, send in the Mailing List form (Reference I). You may also order additional copies of this solicitation from:

DoD SBIR Support Services
2850 Metro Drive, Suite 600
Minneapolis, MN 55425-1566
(800) 382-4634

The DoD SBIR and STTR solicitations can also be accessed via internet through the Home Page at http://www.acq.osd.mil/sadbu/sbir.

1.7 SBIR/STTR Conferences and Outreach

The DoD holds two National SBIR/STTR Conferences a year and participates in many state-organized conferences for small business. For information on these events, see our DoD SBIR/STTR Home Page (**http://www.acq.osd.mil/sadbu/sbir**). We have a special outreach effort to socially and economically disadvantaged firms.

2.0 DEFINITIONS

The following definitions apply for the purposes of this solicitation:

2.1 Research or Research and Development. Systematic study and experimentation directed toward greater knowledge or understanding of the subject studied or toward applying new knowledge to meet a recognized need.

2.2 Cooperative Research and Development. For the purposes of the STTR Program this means research and development conducted jointly by a small business concern and a research institution in which not less than 40 percent of the work is performed by the small business concern, and not less than 30 percent of the work is performed by the research institution. The percent of work is usually measured by both direct and indirect costs; however, proposers should verify how it will be measured with their DoD contracting officer during contract negotiations.

2.3 Small Business Concern. A small business concern is one that, at the time of award of a Phase I or Phase II contract:

a. Is independently owned and operated and organized for profit, is not dominant in the field of operation in which it is proposing, and has its principal place of business located in the United States;

b. Is at least 51% owned, or in the case of a publicly owned business, at least 51% of its voting stock is owned by United States citizens or lawfully admitted permanent resident aliens;

c. Has, including its affiliates, a number of employees not exceeding 500, and meets the other regulatory requirements found in 13 CFR Part 121. Business concerns, other than investment companies licensed, or state development companies qualifying under the Small Business Investment Act of 1958, 15 USC 661, et seq., are affiliates of one another when either directly or indirectly (1) one concern controls or has the power to control the other; or (2) a third party or parties controls or has the power to control both. Control can be exercised through common ownership, common management, and contractual relationships. The term "affiliates" is defined in greater detail in 13 CFR Sec. 121.103. The term "number of employees" is defined in 13 CFR 121.106. Business concerns include, but are not limited to, any individual, partnership, corporation, joint venture, association or cooperative.

2.4 Research Institution. Any organization that is:

a. A university.

b. A nonprofit institution as defined in section 4(5) of the Stevenson-Wydler Technology Innovation Act of 1980.

c. A contractor-operated federally funded research and development center, as identified by the National Science Foundation in accordance with the government-wide Federal Acquisition Regulation issued in accordance with section 35(c)(1) of the Office of Federal Procurement Policy Act. (See Ref. H for a list of eligible FFRDCs.)

2.5 Socially and Economically Disadvantaged Small Business. A small business that is at the time of award of a Phase I or Phase II contract:

a. At least 51% owned by an Indian tribe or a native Hawaiian organization, or one or more socially and economically disadvantaged individuals, and

b. Whose management and daily business operations are controlled by one or more socially and economically disadvantaged individuals.

A socially and economically disadvantaged individual is defined as a member of any of the following groups: Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Subcontinent-Asian Americans, or other groups designated by SBA to be socially disadvantaged.

2.6 Women-Owned Small Business. A small business concern that is at least 51% owned by a woman or women who also control and operate it. "Control" in this context means exercising the power to make policy decisions. "Operate" in this context means being actively involved in the day-to-day management.

2.7 Funding Agreement. Any contract, grant, or cooperative agreement entered into between any federal agency and any small business concern for the performance of experimental, developmental, or research work funded in whole or in part by the federal government. *Only the contract method will be used by DoD components for all STTR awards.*

2.8 Subcontract. A subcontract is any agreement, other than one involving an employer-employee relationship, entered into by a Federal Government contract awardee calling for supplies or services required solely for the performance of the original contract. This includes consultants.

2.9 Commercialization. The process of developing a product or non-R&D service for sale (whether by the originating party or by others) in government and/or private sector markets.

2.10 HBCU/MI. Listings for the Historically Black Colleges and Universities (HBCU) and Minority Institutions (MI) are available through the DTIC website, http://www.dtic.mil/dtic/hbcu.html.

3.0 PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

3.1 Proposal Requirements

A proposal to any DoD Component under the STTR Program is to provide sufficient information to persuade the DoD Component that the proposed work represents an innovative approach to the investigation of an important scientific or engineering problem and is worthy of support under the stated criteria.

The quality of the scientific, technical or commercial content of the proposal will be the principal basis upon which proposals will be evaluated. The proposed research or research and development must be responsive to the chosen topic. Any small business contemplating a bid for work on any specific topic should determine that (a) the technical approach has a reasonable chance of meeting the topic objective, (b) this approach is innovative, not routine, and (c) the firm and research institution team have the capability to implement the technical approach, i.e. have or can obtain people and equipment suitable to the task.

It should be recognized that while the STTR Program requires a small business and a research institution to undertake a project cooperatively, the Federal contract is with the small business. The small business, and not the research institution, is to provide satisfactory evidence that it will exercise management direction and control of the performance of the STTR funding agreement. Regardless of the proportion of the work or funding of each of the performers under the contract, the small business is to be primary contractor with overall responsibility for its performance.

Those responding to this solicitation should note the proposal preparation tips listed below:

- Read and follow all instructions contained in this solicitation.
- Use the technical information services from DTIC and other information assistance organizations (Section 7.1 - 7.3).
- Mark proprietary information as instructed in Section 5.6.
- Limit your proposal to 25 pages (excluding company commercialization report).
- Have an agreement between the small business and research institution in place prior to proposal submission (see Section 3.4.o and Reference C).
- Use a type size no smaller than 12 pitch or 11 point.
- Register your firm on the DoD Electronic Submission Web Site (http://www.dodsbir.net/submission) and, as instructed on the Web Site, prepare a Proposal Cover Sheet and Company Commercialization Report to be included in your proposal.

3.2 Proprietary Information

If information is provided which constitutes a trade secret, proprietary, commercial or financial information, confidential personal information, or data affecting the national security, it will be treated in confidence to the extent permitted by law, provided it is clearly marked in accordance with Section 5.6.

3.3 Limitations on Length of Proposal

This solicitation is designed to reduce the investment of time and cost to small firms in preparing a formal proposal. Those who wish to respond must submit a direct, concise, and informative research or research and development proposal of no more than 25 pages, excluding Company Commercialization Report, (no type smaller than 11 point or 12 pitch on standard 8½" X 11" paper with one (1) inch margins, 6 lines per inch), *including Proposal Cover Sheet, Project Summary, and any enclosures or attachments.* Promotional and non-project related discussion is discouraged. Cover all items listed below in Section 3.4 in the order given. The space allocated to each will depend on the problem chosen and the principal investigator's approach. In the interest of equity, proposals in excess of the 25-page limitation (including attachments, appendices, or references, but excluding Company Commercialization Report) will not be considered for review or award.

3.4 Phase I Proposal Format

a. Page numbering. Number all pages of your proposal consecutively.

b. Proposal Cover Sheet. Register you firm on the password-protected DoD Electronic Submission Web Site (http://www.dodsbir.net/submission). As instructed on the Web Site, prepare a Proposal Cover Sheet, including a brief technical abstract of the proposed R&D project and a discussion of anticipated benefits and potential commercial applications. If your proposal is selected for award, the technical abstract and discussion of anticipated benefits will be publicly released on the Internet; therefore, do not include proprietary or classified information in these sections. Print out a hard copy of the Proposal Cover Sheet from the Web Site and include it, with the appropriate signatures, as the first two pages of your proposal. Also include a photocopy of the signed Proposal Cover Sheet in the additional copies of the proposal that you submit per Section 6.0 of this solicitation. If your firm does not yet have access to the Internet, contact the DoD SBIR/STTR Help Desk (800/382-4634) for assistance.

Through the signature of the Corporate Official of the small business concern and the signature of the appropriate official of the research institution on the Proposal Cover Sheet, the small business concern AND the research institution certify jointly that:

(1) The proposing firm meets the definition of small business concern found in section 2.3, the proposing institution meets the definition of research institution found in section 2.4, and the proposed STTR project meets the definition of cooperative research and development as defined in section 2.2, and

(2) Regardless of the proportion of the proposed project to be performed by each party, the small business concern will be the primary party that will exercise management direction and control of the performance of the STTR award.

(3) At the time of award, the small business concern will have at least one employee in a management position whose primary employment is with the small business and who is not also employed by the research institution.

If the research institution is a contractor-operated Federally funded research and development center, the appropriate official signing for the contractor-operated Federally funded research and development center certifies additionally that it:

(4) Is free from organizational conflicts of interests relative to the STTR program;

(5) Did not use privileged information gained through work performed for an STTR agency or private access to STTR agency personnel in the development of this STTR proposal; and

(6) Used outside peer review as appropriate, to evaluate the proposed project and its performance therein.

c. Identification and Significance of the Problem or Opportunity. Define the specific technical problem or opportunity addressed and its importance. (Begin on Page 3 of your proposal.)

d. Phase I Technical Objectives. Enumerate the specific objectives of the Phase I work, including the questions it will try to answer to determine the feasibility of the proposed approach.

e. Phase I Work Plan. Provide an explicit, detailed description of the Phase I approach. The plan should indicate what is planned, how and where the work will be carried out, a schedule of major events, and the final product to be delivered. Phase I effort should attempt to determine the technical feasibility of the proposed concept. The methods planned to achieve each objective or task should be discussed explicitly and in detail. This section should be a substantial portion of the total proposal.

f. Related Work. Describe significant activities directly related to the proposed effort, including any conducted by the principal investigator, the proposing firm, consultants, or others. Describe how these activities interface with the proposed project and discuss any planned coordination with outside sources. The proposal must persuade reviewers of the proposer's awareness of the state-of-the-art in the specific topic.

Describe previous work not directly related to the proposed effort but similar. Provide the following: (1) short description, (2) client for which work was performed (including individual to be contacted and phone number), and (3) date of completion.

g. Relationship with Future Research or Research and Development.

(1) State the anticipated results of the proposed approach if the project is successful.

(2) Discuss the significance of the Phase I effort in providing a foundation for Phase II research or research and development effort.

h.Commercialization Strategy. Describe, in approximately one page, your company's strategy for converting your proposed STTR research into a product or non-R&D service with widespread commercial use in private sector and/or military markets. Provide specific information on the market need the technology will address and the size of the market. Also include a schedule showing the quantitative commercialization results from this SBIR project that your company expects to achieve and when (i.e., amount of additional investment, sales revenue, etc. – see items a through g in Section 5.4).

i. Key Personnel. Identify key personnel who will be involved in the Phase I effort including information on directly related education and experience. A concise resume of the principal investigator, including a list of relevant publications (if any), must be included.

j. Facilities/Equipment. Describe available instrumentation and physical facilities necessary to carry out the Phase I effort. Items of equipment to be purchased (as detailed in Reference A) shall be justified under this section. Also state whether or not the facilities where the proposed work will be performed meet environmental laws and regulations of federal, state (name) and local governments for, but not limited to, the following groupings: airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid and bulk waste disposal practices, and handling and storage of toxic and hazardous materials.

k. Subcontractors/Consultants. All subcontractors, including the research institution partner, must be identified and described according to the guidelines in Reference A. The STTR program may only make awards to small businesses; therefore, the research institution must have a subcontracting arrangement with the small business. More than one subcontractor is allowed; however, the small business must perform at least 40% of the effort and the research institution listed on Proposal Cover Sheet must perform at least 30% of the work. Subcontractor costs must be detailed at the same level as prime contractor costs in accordance with Reference A (in regards to labor, travel, equipment, etc.). If consultants are involved, such involvement should be described in detail and identified in Reference A.

l. Prior, Current, or Pending Support of Similar Proposals or Awards. *Warning* -- While it is permissible, with proposal notification, to submit identical proposals or proposals containing a significant amount of essentially equivalent work for consideration under numerous federal program solicitations, it is unlawful to enter into contracts or grants requiring essentially equivalent effort. If there is any question concerning this, it must be disclosed to the soliciting agency or agencies before award.

If a proposal submitted in response to this solicitation is substantially the same as another proposal that has been funded, is now being funded, or is pending with another federal agency or DoD Component or the same DoD Component, the proposer must so indicate on the Proposal Cover Sheet and provide the following information:

(1) Name and address of the federal agency(s) or DoD Component to which a proposal was submitted, will be submitted, or from which an award is expected or has been received.
(2) Date of proposal submission or date of award.
(3) Title of proposal.
(4) Name and title of principal investigator for each proposal submitted or award received.
(5) Title, number, and date of solicitation(s) under which the proposal was submitted, will be submitted, or under which award is expected or has been received.
(6) If award was received, state contract number.
(7) Specify the applicable topics for each STTR proposal submitted or award received.

Note: If Section 3.4.l does not apply, state in the proposal "No prior, current, or pending support for proposed work."

m. Cost Proposal. Complete the cost proposal in the form of Reference A for the Phase I effort only. Some items of Reference A may not apply to the proposed project. If such is the case, there is no need to provide information on each and every item. What matters is that enough information be provided to allow the DoD Component to understand how the proposer plans to use the requested funds if the contract is awarded.

(1) List all key personnel by name as well as by number of hours dedicated to the project as direct labor.
(2) Special tooling and test equipment and material cost may be included under Phases I and II. The inclusion of equipment and material will be carefully reviewed relative to need and appropriateness for the work proposed. The purchase of special tooling and test equipment must, in the opinion of the Contracting Officer, be advantageous to the government and should be related directly to the specific topic. These may include such items as innovative instrumentation and/or automatic test equipment. Title to property furnished by the government or acquired with government funds will be vested with the DoD Component, unless it is determined that transfer of title to the contractor would be more cost effective than recovery of the equipment by the DoD Component.
(3) Cost for travel funds must be justified and related to the needs of the project.
(4) Cost sharing is permitted for proposals under this solicitation; however, cost sharing is not required nor will it be an evaluation factor in the consideration of a proposal.

When a proposer is selected for award, the proposer should be prepared to submit further documentation to its DoD contracting officer to substantiate costs (e.g., a brief explanation of cost estimates for equipment, materials, and consultants or subcontractors).

n. Company Commercialization Report on Prior STTR and SBIR awards. If your firm is submitting a Phase I or Phase II proposal, it is required to prepare a Company Commercialization Report through the password-protected DoD Electronic Submission Web Site (http://www.dodsbir.net/submission) As instructed on the Web Site, list in the Report the quantitative commercialization results of your firm's prior Phase II projects, including the items listed in section 5.4a through g of this solicitation (sales revenue, additional investment, etc.). The Web Site will then compare these results to the historical averages for the DoD SBIR/STTR Program. Once your firm has completed the Report on the Web Site, print out a hard copy of the Report, sign and date it, and attach it to the back of your proposal.

Your firm may also, at its option, attach to the back of the Report additional, explanatory material (no more than five pages) relating to the firm's record of commercializing its prior SBIR or STTR projects, such as: commercialization successes (in government and/or private sector markets) that are not fully captured in the quantitative results (e.g. commercialization resulting from your firm's prior Phase I projects); any mitigating factors that could account for low commercialization; and recent changes in the firm's organization or personnel designed to increase the firm's commercialization success. The Company Commercialization Report and additional explanatory material (if any) will not be counted toward the 25-page limit for Phase I proposals.

A Report showing that a firm has received no prior Phase II awards will not affect the firm's ability to obtain an STTR award. Firms that do not yet have access to the Internet should contact the DoD SBIR/STTR Help Desk (800/382-4634) for assistance.

o.Agreement between the Small Business and Research Institution. The small business must negotiate a written agreement with the research institution allocating intellectual property rights and rights, if any, to carry out follow-on research, development, or commercialization. The agreement must be finalized and signed by both parties no later than 15 days after the small business receives notification that it has been selected for a Phase I STTR award. The small business must submit this agreement to the awarding agency on request and certify in all proposals that the agreement is satisfactory to the small business. The agreement should, as a minimum, state:

(1) Specifically the degree of responsibility and ownership of any product, process, or other invention or innovation resulting from the cooperative research. The degree of responsibility shall include responsibility for

expenses and liability, and the degree of ownership shall also include the specific rights to revenues and profits.

(2) Which party may obtain U.S. or foreign patents or otherwise protect any inventions resulting from the cooperative research.

(3) Which party has the right to any continuation of research including non-STTR follow-on awards.

See Reference C for a guideline or model for such an agreement.

The Federal government will not normally be party to any agreement between the small business concern and the research institution. Nothing in the agreement is to conflict with any provisions setting forth the respective rights of the United States and the small business with respect to intellectual property rights and with respect to any right to carry out follow-on research. All agreements between the small business and the research institution cooperating in the STTR projects, or any business plans reflecting agreements and responsibilities between the parties during the performance of Phase I or II, or for the commercialization of the resulting technology, shall reflect the controlling position of the small business.

3.5 Bindings

Do not use special bindings or cover. Staple the pages in the upper left hand corner of each proposal.

3.6 Phase II Proposal

This solicitation is for Phase I only. A Phase II proposal can be submitted only by a Phase I awardee and only in response to a request from the agency; that is, Phase II is not initiated by a solicitation.

Each proposal must contain a Proposal Cover Sheet and a Company Commercialization Report (see section 3.4 b and n). In addition, each Phase II proposal must contain a two-page commercialization strategy, addressing the following questions:

(1) What is the first product that this technology will go into?

(2) Who will be your customers, and what is your estimate of the market size?

(3) How much money will you need to bring the technology to market, and how will you raise the money?

(4) Does your company contain marketing expertise and, if not, how do you intend to bring that expertise into the company?

(5) Who are your competitors, and what is your price and/or quality advantage over your competitors?

The commercialization strategy must also include a schedule showing the quantitative commercialization results from the Phase II project that your company expects to report in its Company Commercialization Report Updates one year after the start of Phase II, at the completion of Phase II, and after the completion of Phase II (i.e., amount of additional investment, sales revenue, etc. – see items a through g in section 5.4).

Additional instructions regarding Phase II proposal preparation and submission will be provided or made available by the DoD Components to all Phase I winners at time of Phase I contract award.

3.7 False Statements

Knowingly and willfully making any false, fictitious, or fraudulent statements or representations may be a felony under the Federal Criminal False Statement Act (18 U.S.C. Sec 1001), punishable by a fine of up to $10,000, up to five years in prison, or both.

4.0 METHOD OF SELECTION AND EVALUATION CRITERIA

4.1 Introduction

Phase I proposals will be evaluated on a competitive basis and will be considered to be binding for six (6) months from the date of closing of this solicitation unless offeror states otherwise. If selection has not been made prior to the proposal's expiration date, offerors will be requested as to whether or not they want to extend their proposal for an additional period of time. Proposals meeting stated solicitation requirements will be evaluated by scientists or engineers knowledgeable in the topic area. Proposals will be evaluated first on their relevance to the chosen topic. A proposal that meets the goals of a solicitation topic but does not use the exact approach specified in the topic will be considered relevant. (Prospective proposers should contact the topic author as described in Section 1.5 to determine whether submission of such a proposal would be useful.)

Proposals found to be relevant will then be evaluated using the criteria listed in Section 4.2. Final decisions will be made by the DoD Component based upon these criteria and consideration of other factors including possible duplication of other work, and program balance. A DoD Component may elect to fund several or none of the proposed approaches to the same topic. In the evaluation and handling of proposals, every effort will be made to protect the confidentiality of the proposal and any evaluations. There is no commitment by the DoD Components to make any awards on any topic, to make a specific number of awards or to be responsible for any monies expended by the proposer before award of a contract.

For proposals that have been selected for contract award, a Government Contracting Officer will draw up an appropriate contract to be signed by both parties before work begins. Any negotiations that may be necessary will be conducted between the offeror and the Government Contracting Officer. It should be noted that only a duly appointed contracting officer has the authority to enter into a contract on behalf of the U.S. Government.

Phase II proposals will be subject to a technical review process similar to Phase I. Final decisions will be made by DoD Components based upon the scientific and technical evaluations and other factors, including a commitment for Phase III follow-on funding, the possible duplication with other research or research and development, program balance, budget limitations, and the potential of a successful Phase II effort leading to a product of continuing interest to DoD. DoD is not obligated to make any awards under Phase II or the Fast Track, and all awards are subject to the availability of funds. DoD is not responsible for any monies expended by the proposer before award of a contract.

Upon written request and after final award decisions have been announced, a debriefing will be provided to unsuccessful offerors on their proposals.

4.2 Evaluation Criteria - Phase I

The DoD Components plan to select for award those proposals offering the best value to the government and the nation considering the following factors.

a. The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.

b. The qualifications of the proposed principal/key investigators, supporting staff, and consultants. Qualifications include not only the ability to perform the research and development but also the ability to commercialize the results.

c. The potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization.

Where technical evaluations are essentially equal in merit, cost to the government will be considered in determining the successful offeror.

Technical reviewers will base their conclusions only on information contained in the proposal. It cannot be assumed that reviewers are acquainted with the firm or key individuals or any referenced experiments. Relevant supporting data such as journal articles, literature, including government publications, etc., should be contained or referenced in the proposal.

4.3 Evaluation Criteria - Phase II

The Phase II proposal will be reviewed for overall merit based upon the criteria below.

a. The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution

b. The qualifications of the proposed principal/key investigators, supporting staff, and consultants. Qualifications include not only the ability to perform the research and development by also the ability to commercialize the results.

c. The potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization.

The reasonableness of the proposed costs of the effort to be performed will be examined to determine those proposals that offer the best value to the government. Where technical evaluations are essentially equal in merit, cost to the government will be considered in determining the successful offeror.

Phase II proposal evaluation may include on-site evaluations of the Phase I effort by Government personnel.

Fast Track Phase II proposals. Under the regular Phase II evaluation process, the above three criteria are each given roughly equal weight (with some variation across the DoD Components). For projects that qualify for the Fast Track (as discussed in Section 4.5), DoD will evaluate the Phase II proposals under a separate, expedited process in accordance with the above criteria, and will select these proposals for Phase II award provided:

(1) they meet or exceed a threshold of "technically sufficient" for criteria (a) and (b); and
(2) the project has substantially met its Phase I technical goals

(and assuming budgetary and other programmatic factors are met, as discussed in Section 4.1). Fast Track proposals, having attracted matching cash from an outside investor, presumptively meet criterion (c). Consistent with DoD policy, this process should result in a significantly higher percentage of Fast Track projects obtaining Phase II award than non-Fast Track projects.

4.4 Assessing Commercial Potential of Proposals

A Phase I or Phase II proposal's commercial potential will be assessed using the following criteria:

a. The proposer's commercialization strategy (see Sections 3.4h and 3.6) and, as discussed in that strategy: (1) any commitments of additional investment in the technology during Phase II from the private sector, DoD prime contractors, non-SBIR/STTR DoD programs, or other sources, and (2) any Phase III follow-on funding commitments; and

b. The proposer's record of commercializing its prior SBIR and STTR projects, as shown in its Company Commercialization Report (see Section 3.4n). If the "Commercialization Achievement Index" shown on the first page of the Report is at the 5th percentile or below, the proposer will receive no more than half of the evaluation points available under evaluation criterion c in Sections 4.2 and 4.3 ("potential for commercialization"), unless the SBIR program manager for the DoD Component receiving the proposal (Army, Navy, Air Force, etc.) recommends, in writing, that an exception be made for that proposer, and the contracting officer approves the exception.

A Company Commercialization Report showing that the proposing firm has no prior Phase II awards will not affect the firm's ability to win an award. Such a firm's proposal will be evaluated for commercial potential based on its commercialization strategy in item a, above.

4.5 STTR Fast Track

a. In General. The DoD STTR program has implemented a streamlined Fast Track process for SBIR projects that attract matching cash from an outside investor for the Phase II STTR effort (as well as for the interim effort between Phases I and II). The purpose is to focus STTR funding on those projects that are most likely to be developed into viable new products that DoD and others will buy and that will thereby make a major contribution to U.S. military and/or economic capabilities.

Outside investors, as defined in DoD's Fast Track Guidance (Reference G), may include such entities as another company, a venture capital firm, an individual investor, or a non-SBIR, non-STTR government program; they do not include the owners of the small business, their family members, and/or affiliates of the small business.

As discussed in detail below, projects that obtain matching funds from outside investors and thereby qualify for the STTR Fast Track will (subject to the qualifications described herein):

(1) Receive interim funding of $30,000 to $50,000 between Phases I and II;
(2) Be evaluated for Phase II award under a separate, expedited process; and
(3) Be selected for Phase II award provided they meet or exceed a threshold of "technically sufficient" and have substantially met their Phase I technical goals (and assuming other programmatic factors are met), as described in Section 4.3.

Consistent with DoD policy, this process should prevent any significant gaps in funding between Phases I and II for Fast Track projects, and result in a significantly higher percentage of Fast Track projects obtaining Phase II award than non-Fast Track projects.

All DoD Components administer the Fast Track according to the procedures in this section, except for BMDO. BMDO administers slightly different procedures that have been approved by the Under Secretary of Defense for Acquisition and Technology – see the BMDO proposal instructions in Section 8 of this solicitation.

b. How To Qualify for the STTR Fast Track. To qualify for the STTR Fast Track, a company must submit a Fast Track application at least 60 days prior to completion of its Phase I project, unless a different deadline for Fast Track applications is specified by the DoD component funding the project (see the Component's introductory page in Section 8 of this solicitation). The company is encouraged to discuss the application with its Phase I technical monitor; however, it need not wait for an invitation from the technical monitor to submit either a Fast Track application or a Fast Track Phase II proposal.

A Fast Track application consists of the following items:

(1) A completed Fast Track application form, found at Reference B. On the application form, the company and its outside investor must:

(a) State that the outside investor will match both interim and Phase II STTR funding, in cash, contingent on the company's selection for Phase II award, as described on the form at Reference B. The matching rates needed to qualify for the Fast Track are as follows:

- For companies that have never received a Phase II SBIR or STTR award from DoD or any other federal agency, the minimum matching rate is 25 cents for every STTR dollar. (For Example, if such a company receives interim and Phase II STTR funding that totals $500,000, it must

obtain matching funds from the investor of $125,000.)

- For all other companies, the minimum matching rate is 1 dollar for every STTR dollar. (For example, if such a company receives interim and Phase II STTR funding that totals $500,000, it must obtain matching funds from the investor of $500,000.)

(b) Certify that the outside funding proposed in the application qualifies as a "Fast Track investment," and the investor qualifies as an "outside investor," as defined in DoD Fast Track Guidance (Reference G).

(2) A letter from the outside investor to the company, containing:

(a) A commitment to match both interim and Phase II STTR funding, in cash, contingent on the company's selection for Phase II award, as discussed on the form at Reference B.

(b) A brief statement (less than one page) describing that portion of the effort that the investor will fund. The investor's funds may pay for additional research and development on the company's STTR project or, alternatively, they may pay for other activities not included in the Phase II contract's statement of work, provided these activities further the development and/or commercialization of the technology (e.g., marketing).

(c) A brief statement (less than one page) describing (i) the investor's experience in evaluating companies' ability to successfully commercialize technology; and (ii) the investor's assessment of the market for this particular STTR technology, and of the ability of the company to bring this technology to market.

(3) A concise statement of work for the interim STTR effort (less than four pages) and detailed cost proposal (less than one page). Note: if the company has already negotiated an interim effort (e.g., an "option") of $30,000 to $50,000 with DoD as part of its Phase I contract, it need only cite that section of its contract, and need not submit an additional statement of work and cost proposal.

The company should send its Fast Track application to its Phase I technical monitor, with copies to the appropriate Component program manager and to the DoD STTR program manager, as indicated on the back of the application form.

Also, in order to qualify for the Fast Track, the company:

(1) Must submit its Phase II proposal no later than 30 days prior to completion of its Phase I contract, unless a different deadline for Fast Track Phase II proposals is specified by the DoD Component funding the contract (see the Component's introductory page in Section 8 of this solicitation).

(2) Must submit its Phase I final report by the deadline specified in its Phase I contract, but not later than 30 days after the effective start date of the contract.

(3) Must certify, within 45 days after being notified that it has been selected for Phase II award, that the entire amount of the matching funds from the outside investor has been transferred to the company. Certification consists of a letter, signed by both the company and its outside investor, stating that "$_____ in cash has been transferred to our company from our outside investor in accord with the STTR Fast Track procedures." The letter must be sent to the DoD contracting office along with a copy of the company's bank statement showing the funds have been deposited. IMPORTANT: If the DoD contracting office does not receive, within the 45 days, this certification showing the transfer of funds, the company will be ineligible to compete for a Phase II award not only under the Fast Track but also under the regular Phase II competition, unless a specific written exception is granted by the Component's STTR program manager. Before signing the certification letter, the company and investor should read the cautionary note at Section 3.7. If the outside investor is a non-SBIR/non-STTR DoD program, it must provide a line of accounting within the 45 days that can be accessed immediately.

Failure to meet these conditions in their entirety and within the time frames indicated will generally disqualify a company from participation in the STTR Fast Track. Deviations from these conditions must be approved in writing by the contracting office.

c. Benefits of Qualifying for the Fast Track. If a project qualifies for the Fast Track:

(1) It will receive interim STTR funding of $30,000 to $50,000, commencing approximately at the end of Phase I. Note: Consistent with DoD policy, the vast majority of projects that qualify for the Fast Track should receive interim STTR funding. However, the DoD contracting office has the discretion and authority, in any particular instance, to deny interim funding when doing so is in the Government's interest (e.g., when the project no longer meets a military need or the statement of work does not meet the threshold of "technically sufficient" as described in Section 4.3).

(2) DoD will evaluate the Fast Track Phase II proposal under a separate, expedited process, and will select the proposal for Phase II award provided it meets or exceeds a threshold of "technically sufficient" for evaluation criteria (a) and (b), as described in Section 4.3 (assuming

budgetary and other programmatic factors are met, as discussed in Section 4.1). Consistent with DoD policy, this process should result in a significantly higher percentage of Fast Track projects obtaining Phase II award than non-Fast Track projects. However, DoD is not obligated, in any particular instance, to award a Phase II contract to a Fast Track project, and DoD is not responsible for any funds expended by the proposer before award of a contract.

(3) It will receive notification, no later than ten weeks after the completion of its Phase I project, of whether it has been selected for Phase II award.

(4) If selected, it will receive its Phase II award within an average of five months from the completion of its Phase I project.

d. Additional Reporting Requirement. In the company's final Phase II progress report, it must include a brief accounting (in the company's own format) of how the investor's funds were expended to support the project.

5.0 CONTRACTUAL CONSIDERATIONS

Note: Eligibility and Limitation Requirements (Section 1.3) Will Be Enforced

5.1 Awards (Phase I)

a. Number of Phase I Awards. The number of Phase I awards will be consistent with the agency's RDT&E budget, the number of anticipated awards for interim Phase I modifications, and the number of anticipated Phase II contracts. No Phase I contracts will be awarded until all qualified proposals (received in accordance with Section 6.2) on a specific topic have been evaluated. All proposers will be notified of selection/non-selection status for a Phase I award no later than October 12, 2001. The name of those firms selected for awards will be announced. *The DoD Components anticipate making 50 Phase I awards from this solicitation.*

b. Type of Funding Agreement. All winning proposals will be funded under negotiated contracts and may include a fee or profit. The firm fixed price or cost plus fixed fee type contract will be used for all Phase I projects (see Section 5.4). *Note: The firm fixed price contract is the preferred type for Phase I.*

c. Average Dollar Value of Awards. DoD Components will make Phase I awards to small businesses typically on a one-half person-year effort over a period generally not to exceed one year (subject to negotiation). PL 102-564 allows agencies to award Phase I contracts up to $100,000 without justification. The typical size of award varies across the DoD Components; it is therefore important for a proposer to read the introductory page of the Component to which it is applying (in Section 8.0) for any specific instructions regarding award size.

5.2 Awards (Phase II)

a. Number of Phase II Awards. The number of Phase II awards will depend upon the results of the Phase I efforts and the availability of funds. *The DoD Components anticipate that approximately 40 percent of its Phase I awards will result in Phase II projects.*

b. Type of Funding Agreement. Each Phase II proposal selected for award will be funded under a negotiated contract and may include a fee or profit. The firm fixed price or cost plus fixed fee type contract will be used for all Phase II projects. *Note: The firm fixed price, level-of-effort contract is the preferred type for Phase II (see sample on our DoD SBIR/STTR Web Site at http://www.acq.osd.mil/sadbu/sbir/contract.html), except in the Air Force, where cost plus fixed fee is the preferred type.*

c. Average Dollar Value of Awards. Phase II awards will be made to small businesses based on results of the Phase I efforts and the scientific, technical, and commercial merit of the Phase II proposal. Average Phase II awards will typically cover 2 to 5 person-years of effort over a period generally not to exceed 24 months (subject to negotiation). PL 102-564 states that the Phase II awards may be up to $500,000 each without justification. See special instructions for each DoD Component in Section 8.

5.3 Phase I Report

a. Content. A final report is required for each Phase I project. The report must contain in detail the project objectives, work performed, results obtained, and estimates of technical feasibility. A completed SF 298, "Report Documentation Page", will be used as the first page of the report. (A blank SF 298 is provided in Reference F of this solicitation.) In addition, monthly status and progress reports may be required by the DoD agency.

b. Preparation.

(1) If desirable, language used by the company in its Phase II proposal to report Phase I progress may also be used in the final report.

(2) For each unclassified report, the company submitting the report should fill in block 12a (Distribution/Availability Statement) of the SF298, "Report Documentation Page" with one of the following statements:
   (a) Approved for public release; distribution unlimited.
   (b) Distribution authorized to U.S. Government Agencies only; contains proprietary information.

   Note: The sponsoring DoD activity, after reviewing the company's entry in block 12a, has final responsibility for assigning a distribution statement.

(3) Block 13 (Abstract) of the SF 298, "Report Documentation Page" must include as the first sentence, "Report developed under STTR contract for topic [insert solicitation topic number]". The abstract must identify the purpose of the work and briefly describe the work carried out, the findings or results and the potential applications of the effort. Since the abstract will be published by the DoD, it must not contain any proprietary or classified data.

(4) Block 14 (Subject Terms) of the SF 298 must include the term "STTR Report".

c. Submission. The company shall submit FIVE COPIES of the final report on each Phase I project to the DoD in accordance with the negotiated delivery schedule. Delivery will normally be within thirty days after completion of the Phase I technical effort. The company shall, at the same time, submit ONE ADDITIONAL COPY of each report directly to DTIC (unless instructed otherwise by the sponsoring DoD activity in the Phase I contract):

ATTN: DTIC-OCA
Defense Technical Information Center
8725 John J Kingman Road, Suite 0944
Ft. Belvoir, VA 22060-6218.

If the report is classified, the sponsoring DoD activity will provide special submission instructions. *Note: The*

sponsoring DoD activity has final responsibility for ensuring that the company or the DoD activity provide DTIC with all applicable Phase I and Phase II technical reports, classified and unclassified, developed under STTR contract, per DoD Instructions 3200.14 (http://web7.whs.osd.mil/dodiss/instructions/ins2.html)

5.4 Company Commercialization Report Updates

If, after completion of Phase I, the contractor is awarded a Phase II contract, the contractor shall be required to electronically update its Company Commercialization Report (discussed in Section 3.4n) on a periodic basis, to report the following commercialization results of this Phase II project:

a. Sales revenue from new products and non-R&D services resulting from the Phase II technology;
b. Additional investment from sources other than the federal SBIR/STTR program in activities that further the development and/or commercialization of the Phase II technology;
c. The portion of additional investment representing clear and verifiable investment in the future commercialization of the technology (i.e., "hard investment);
d. Whether the Phase II technology has been used in a fielded DoD system or acquisition program and, if so, which system or program;
e. The number of patents resulting from the contractor's participation in the SBIR/STTR program;
f. Growth in number of firm employees; and
g. Whether the firm has completed an initial public offering of stock (IPO) resulting, in part, from the Phase II project.

These updates on the project will be required one year after the start of Phase II, at the completion of Phase II, and subsequently when the contractor submits a new SBIR or STTR proposal to DoD. Firms that do not submit a new proposal to DoD will be asked to provide updates on an annual basis after the completion of Phase II.

5.5 Payment Schedule

The specific payment schedule (including payment amounts) for each contract will be incorporated into the contract upon completion of negotiations between the DoD and the successful Phase I or Phase II offeror. Successful offerors may be paid periodically as work progresses in accordance with the negotiated price and payment schedule. Phase I contracts are primarily fixed price contracts, under which monthly payments may be made. The contract may include a separate provision for payment of a fee or profit. Final payment will follow completion of contract performance and acceptance of all work required under the contract. Other types of financial assistance may be available under the contract.

5.6 Markings of Proprietary or Classified Proposal Information

The proposal submitted in response to this solicitation may contain technical and other data which the proposer does not want disclosed to the public or used by the government for any purpose other than proposal evaluation.

Information contained in unsuccessful proposals will remain the property of the proposer except for the Proposal Cover Sheet. The government may, however, retain copies of all proposals. Public release of information in any proposal submitted will be subject to existing statutory and regulatory requirements.

If proprietary information is provided by a proposer in a proposal which constitutes a trade secret, proprietary commercial or financial information, confidential personal information or data affecting the national security, it will be treated in confidence, to the extent permitted by law, provided this information is clearly marked by the proposer with the term "confidential proprietary information" and provided that the following legend which appears on the Proposal Cover Sheet (Section 3.4b) is completed:

> "For any purpose other than to evaluate the proposal, this data referenced below, shall not be disclosed outside the government and shall not be duplicated, used, or disclosed in whole or in part, provided that if a contract is awarded to the proposer as a result of or in connection with the submission of this data, the government shall have the right to duplicate, use or disclose the data to the extent provided in the funding agreement. This restriction does not limit the government's right to use information contained in the data if it is obtained from another source without restriction. The data subject to this restriction is contained on the pages of the proposal listed on the line below"

Any other legend may be unacceptable to the government and may constitute grounds for removing the proposal from further consideration and without assuming any liability for inadvertent disclosure. The government will limit dissemination of properly marked information to within official channels.

In addition, each page of the proposal containing proprietary data which the proposer wishes to restrict must be marked with the following legend:

> "Use or disclosure of the proposal data on lines specifically identified by asterisk (*) are subject to the restriction on the Cover Sheet of this proposal."

If all the information on a particular page is proprietary, the proposer should so note by including the word "PROPRIETARY" in both the header and footer on that page.

The government assumes no liability for disclosure or use of unmarked data and may use or disclose such data for any purpose.

In the event properly marked data contained in a proposal in response to this solicitation is requested pursuant to the Freedom of Information Act, 5 USC 552, the proposer will be advised of such request and prior to such release of information will be requested to expeditiously submit to the DoD Component a detailed listing of all information in the proposal which the proposer believes to be exempt from disclosure under the Act. Such

action and cooperation on the part of the proposer will ensure that any information released by the DoD Component pursuant to the Act is properly determined.

Those proposers that have a classified facility clearance may submit classified material with their proposal. Any classified material shall be marked and handled in accordance with applicable regulations. Arbitrary and unwarranted use of this restriction is discouraged. Offerors must follow the Industrial Security Manual for Safeguarding Classified Information (DoD 5220.22M) procedures for marking and handling classified material.

5.7 Copyrights

To the extent permitted by statute, the awardee may copyright (consistent with appropriate national security considerations, if any) material developed with DoD support. DoD receives a royalty-free license for the Federal Government and requires that each publication contain an appropriate acknowledgement and disclaimer statement.

5.8 Patents

Small business firms normally may retain the principal worldwide patent rights to any invention developed with government support. The government receives a royalty-free license for its use, reserves the right to require the patent holder to license others in certain limited circumstances, and requires that anyone exclusively licensed to sell the invention in the United States must normally manufacture it domestically. To the extent authorized by 35 USC 205, the government will not make public any information disclosing a government-supported invention for a period of five years to allow the awardee to pursue a patent.

5.9 Technical Data Rights

Rights in technical data, including software, developed under the terms of any contract resulting from proposals submitted in response to this solicitation generally remain with the contractor, except that the government obtains a royalty-free license to use such technical data only for government purposes during the period commencing with contract award and ending five years after completion of the project under which the data were generated. Upon expiration of the five-year restrictive license, the government has unlimited rights in the STTR data. During the license period, the government may not release or disclose STTR data to any person other than its support services contractors except: (1) For evaluational purposes; (2) As expressly permitted by the contractor; or (3) A use, release, or disclosure that is necessary for emergency repair or overhaul of items operated by the government. See FAR clause 52.227-20, "Rights in Data - SBIR Program" and DFARS 252.227-7018, "Rights in Noncommercial Technical Data and Computer Software -- SBIR Program."

5.10 Cost Sharing

Cost sharing is permitted for proposals under this solicitation; however, cost sharing is not required nor will it be an evaluation factor in the consideration of any Phase I proposal.

5.11 Joint Ventures or Limited Partnerships

Joint ventures and limited partnerships are eligible provided the entity created qualifies as a small business as defined in Section 2.2 of this solicitation.

5.12 Research and Analytical Work

For Phase I and II, a minimum of 40 percent of the research and/or analytical effort must be performed by the proposing firm and a minimum of 30 percent performed by the research institution unless otherwise approved in writing by the contracting officer. The percentage of work is usually measured by both direct and indirect costs; however, proposers should verify how it will be measured with their contracting officer during contract negotiations.

5.13 Contractor Commitments

Upon award of a contract, the contractor will be required to make certain legal commitments through acceptance of government contract clauses in the Phase I contract. The outline that follows is illustrative of the types of provisions required by the Federal Acquisition Regulations that will be included in the Phase I contract. This is not a complete list of provisions to be included in Phase I contracts, nor does it contain specific wording of these clauses. Copies of complete general provisions will be made available prior to award.

a.Standards of Work. Work performed under the contract must conform to high professional standards.

b.Inspection. Work performed under the contract is subject to government inspection and evaluation at all reasonable times.

c. Examination of Records. The Comptroller General (or a fully authorized representative) shall have the right to examine any directly pertinent records of the contractor involving transactions related to this contract.

d.Default. The government may terminate the contract if the contractor fails to perform the work contracted.

e. Termination for Convenience. The contract may be terminated at any time by the government if it deems termination to be in its best interest, in which case the contractor will be compensated for work performed and for reasonable termination costs.

f. Disputes. Any dispute concerning the contract which cannot be resolved by agreement shall be decided by the contracting officer with right of appeal.

g. Contract Work Hours. The contractor may not require an employee to work more than eight hours a day or

forty hours a week unless the employee is compensated accordingly (that is, receives overtime pay).

h. Equal Opportunity. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.

i. Affirmative Action for Veterans. The contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran or veteran of the Vietnam era.

j. Affirmative Action for Handicapped. The contractor will not discriminate against any employee or applicant for employment because he or she is physically or mentally handicapped.

k. Officials Not to Benefit. No member of or delegate to Congress shall benefit from the contract.

l. Covenant Against Contingent Fees. No person or agency has been employed to solicit or secure the contract upon an understanding for compensation except bona fide employees or commercial agencies maintained by the contractor for the purpose of securing business.

m. Gratuities. The contract may be terminated by the government if any gratuities have been offered to any representative of the government to secure the contract.

n. Patent Infringement. The contractor shall report each notice or claim of patent infringement based on the performance of the contract.

o. Military Security Requirements. The contractor shall safeguard any classified information associated with the contracted work in accordance with applicable regulations.

p. American Made Equipment and Products. When purchasing equipment or a product under the STTR funding agreement, purchase only American-made items whenever possible.

5.14 Contractor Registration [NEW]

Before DoD can award a contract to a successful proposer under this solicitation, the proposer must be registered in the DoD Central Contractor Registration database. To register, see http://ccr.edi.disa.mil or call 1-888-227-2423.

5.15 Additional Information

a.General. This Program Solicitation is intended for information purposes and reflects current planning. If there is any inconsistency between the information contained herein and the terms of any resulting STTR contract, the terms of the contract are controlling.

b.Small Business Data. Before award of an STTR contract, the government may request the proposer to submit certain organizational, management, personnel, and financial information to confirm responsibility of the proposer.

c. Proposal Preparation Costs. The government is not responsible for any monies expended by the proposer before award of any contract.

d.Government Obligations. This Program Solicitation is not an offer by the government and does not obligate the government to make any specific number of awards. Also, awards under this program are contingent upon the availability of funds.

e. Unsolicited Proposals. The STTR Program is not a substitute for existing unsolicited proposal mechanisms. Unsolicited proposals will not be accepted under the STTR Program in either Phase I or Phase II.

f. Duplication of Work. If an award is made pursuant to a proposal submitted under this Program Solicitation, the contractor will be required to certify that he or she has not previously been, nor is currently being, paid for essentially equivalent work by an agency of the Federal Government.

g. Classified Proposals. If classified work is proposed or classified information is involved, the offeror to the solicitation must have, or obtain, security clearance in accordance with the Industrial Security Manual for Safeguarding Classified Information (DoD 5220.22M). The Manual is available on-line at http://www.dis.mil or in hard copy from:

Defense Investigative Service
1340 Braddock Place
Alexandria, VA 22314
Phone: (703) 325-5324

6.0 SUBMISSION OF PROPOSALS

An original plus (4) copies of each proposal or modification will be submitted, in a single package, as described below, unless otherwise stated by specific instructions in Section 8.0.

NOTE: EACH PROPOSAL MUST CONTAIN A COMPLETED PROPOSAL COVER SHEET AND COMPANY COMMERCIALIZATION REPORT (see Section 3.4b and n).

6.1 Address

Each proposal or modification thereof shall be submitted in sealed envelopes or packages addressed to the DoD Component address which is identified for the specific topic in that Component's subsection of Section 8.0 of this solicitation.

The name and address of the offeror, the solicitation number, the topic number for the proposal, and the time and date specified for proposal receipt must be clearly marked on the face of the envelope or package. To protect your proposal against rough handling, damage in the mail, and the possibility of unauthorized disclosures, it is recommended that your proposal be double-wrapped and that both the inner and outer envelopes or wrappings be clearly marked.

Offerors using commercial carrier services shall ensure that the proposal is addressed and marked on the outermost envelope or wrapper as prescribed above.

Mailed or hand-carried proposals must be delivered to the address indicated for each topic. Secured packaging is mandatory. The DoD Component cannot be responsible for the processing of proposals damaged in transit.

All copies of a proposal must be sent in the same package. Do not send separate information copies or several packages containing parts of the single proposal.

6.2 Deadline of Proposals

Deadline for receipt of proposals at the DoD Component is 2:00 p.m. local time, April 11, 2001. Any proposal received at the office designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before an award is made, and:

(a) it was sent by registered or certified mail not later than April 4, 2001;

(b) it was sent by mail or hand-carried (including delivery by a commercial carrier) and it is determined by the Government that the late receipt was due primarily to Government mishandling after receipt at the Government installation; or

(c) it was sent by U.S. Postal Service Express Mail Next Day Service-Post Office to Addressee, not later than 5:00 p.m. at the place of mailing on April 10, 2001.

Note: There are no other provisions for late receipt of proposals under this solicitation.

The only acceptable evidence to establish the date of mailing of a late proposal sent either by registered or certified mail is the U. S. Postal Service postmark on the envelope or wrapper and on the original receipt from the U.S. Postal Service. Both postmarks must show a legible date or the proposal shall be processed as if mailed late. "Postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed by employees of the U. S. Postal Service on the date of mailing. Therefore, offerors or respondents should request the postal clerk to place a legible hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper. Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of the installation on the proposal wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel. The only acceptable evidence to establish the date of mailing of a late proposal sent by Express Mail Next Day Service-Post Office to Addressee is the date entered by the post office receiving clerk on the "Express Mail Next Day Service-Post Office to Addressee" label and the postmark on both the envelope or wrapper and on the original receipt from the U.S. Postal Service. Therefore, offerors should request the postal clerk to place a legible hand cancellation bull's eye postmark on both the receipt and the envelope or wrapper.

Proposals may be withdrawn by written notice or a telegram received at any time prior to award. Proposals may also be withdrawn in person by an offeror or his authorized representative, provided his identity is made known and he signs a receipt for the proposal. *(Note: the term telegram includes mailgrams.)*

Any modification or withdrawal of a proposal is subject to the same conditions outlined above. Any modification may not make the proposal longer than 25 pages (excluding Company Commercialization Report). Notwithstanding the above, a late modification of an otherwise successful proposal which makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

6.3 Notification of Proposal Receipt

Proposers desiring notification of receipt of their proposal must complete and include a self-addressed stamped envelope and a copy of the notification form (Reference D) in the back of this brochure. If multiple proposals are submitted, a separate form and envelope is required for each. Notification of receipt of a proposal by the government does not by itself constitute a determination that the proposal was received on time or not. The determination of timeliness is solely governed by the criteria set forth in Section 6.2.

6.4 Information on Proposal Status

Evaluation of proposals and award of contracts will be expedited, but no information on proposal status will be available until the final selection is made. However, contracting officers may contact any and all qualified proposers prior to contract award.

6.5 Debriefing of Unsuccessful Offerors

An unsuccessful offeror that submits a written request for a debriefing within 30 days of being notified that its proposal was not selected for award will be provided a debriefing. The written request should be sent to the DoD organization that provided such notification to the offeror. Be advised that an offeror that fails to submit a timely request is not entitled to a debriefing, although untimely debriefing requests may be accommodated at the government's discretion.

6.6 Correspondence Relating to Proposals

All correspondence relating to proposals should cite the STTR solicitation number and specific topic number and should be addressed to the DoD Component whose address is associated with the specific topic number.

7.0 SCIENTIFIC AND TECHNICAL INFORMATION ASSISTANCE

7.1 DoD Technical Information Services Available

The Defense Technical Information Center (DTIC), provides information support to assist STTR participants in proposal preparation, bid decisions, product development, marketing and networking. The following services are available at no cost. See the DTIC SBIR/STTR web site (http://www.dtic.mil/dtic/sbir) for additional information.

1. **Public STINET,** DTIC's online technical database, is on the web site. In addition to citations going back to 1974, STINET includes thousands of recent full-text reports, which can be downloaded at no cost. STTR participants are encouraged to search the database for documents in their areas of interest.
2. **TRAIL** (http://www.dtic.mil/trail) an e-mail document alert service available to SBIR/STTR participants, provides listings biweekly of new DTIC accessions matching the recipient's interest profile.
3. **Free Reports:** A firm may receive a total of ten hard copy technical reports at no cost from DTIC during an SBIR/STTR solicitation period. Additional reports and services may be charged to a credit card or deposit account.
4. **SITIS,** providing answers to specific technical questions concerning DoD topic descriptions, is also on the web site. See the description of SITIS in Section 1.5.c.

DTIC is a major component of the DoD Scientific and Technical Information Program, managing the technical information resulting from DoD-funded research and development (http://www.dtic.mil). DTIC also manages and provides access to specialized information services and subject matter expertise. MATRIS, a DTIC component, is the focal point for information on manpower, training systems, human performance, and human factors (http://dticam.dtic.mil). The DTIC-managed Centers for Analysis of Scientific and Technical Information (the IACs) are the DoD centers of expertise concerned with engineering, technical and scientific documents and databases worldwide (http://www.dtic.mil/iac/).

Call, or visit (by pre-arrangement), DTIC at the location most convenient to you. Written communication should be made to the Ft. Belvoir address.

ATTN: DTIC-SBIR
Defense Technical Information Center
8725 John J Kingman Rd, Suite 0944
Ft Belvoir VA 22060-6218
Phone (800) 363-7247
Fax (703) 767-8228
EMail sbir@dtic.mil
WWW http://www.dtic.mil/dtic/sbir

DTIC Northeastern Regional Office
ATTN: DTIC-BPB
Building 1103, 5 Wright Street
Hanscom AFB, MA 01731-3012
Ph: (781) 377-2413
Fax: (781) 377-5627
Email: boston@dtic.mil

DTIC Midwestern Regional Office
ATTN: DTIC-BPD
Bldg. 196, Area B
2261 Monahan Way
Wright-Patterson AFB, OH 45433-7022
Ph: (937) 255-7905
Fax: (937) 656-7002
Email: dayton@dtic.mil

DTIC Western Regional Office
ATTN: DTIC-BPL
Bldg. 80
2420 Vela Way, Suite 1467
El Segundo, CA 90245-4659
Ph: (310) 363-8980
Fax: (310) 363-8972
Email: losangel@dtic.mil

DTIC Southwestern Regional Office
ATTN: DTIC-BPA
3550 Aberdeen Ave, SE
Kirtland AFB, NM 87117-5776
Ph: (505) 846-6797
Fax: (505) 846-6799
Email: albuq@dtic.mil

7.2 DoD Counseling Assistance Available

Small business firms interested in participating in the STTR Program may seek general administrative guidance from small and disadvantaged business utilization specialists located in various Defense Contract Management activities throughout the continental United States. These specialists are available to discuss general administrative requirements to facilitate the submission of proposals and ease the entry of the small high technology business into the Department of Defense marketplace. The small and disadvantaged business utilization specialists are expressly prohibited from taking any action which would give an offeror an unfair advantage over others, such as discussing or explaining the technical requirements of the solicitation, writing or discussing technical or cost proposals, estimating cost or any other actions which are the offerors responsibility as outlined in this solicitation. (See Reference E at the end of this solicitation for a complete listing, with telephone numbers, of Small and Disadvantaged Business Utilization Specialists assigned to these activities.)

7.3 State Assistance Available

Many states have established programs to provide services to those small firms and individuals wishing to participate in the Federal STTR Program. These services vary from state to state, but may include:

- Information and technical assistance;
- Matching funds to STTR recipients;
- Assistance in obtaining Phase III funding.

Contact your State Government Office of Economic Development for further information.

8.0 TECHNICAL TOPICS

Section 8 contains detailed topic descriptions outlining the technical areas in which DoD Components request proposals for innovative R&D from small businesses. Topics for each participating DoD Component are listed and numbered separately. A number of Army, Navy and Air Force topics either are authored by a DoD acquisition program (e.g., New Attack Submarine, Abrams Tank) or are of significant interest to such a program, as noted in the text of the topic. These acquisition programs are potentially important end customers for innovative new products resulting from SBIR projects. Information on how to contact these programs is posted on the Web Site (http://www.acq.osd.mil/sadbu/sbir/acqprog/liaisons.htm).

Each DoD Component Topic Section contains topic descriptions, addresses of organizations to which proposals are to be submitted, and special instructions for preparing and submitting proposals to organizations within the component. Read and follow these instructions carefully to help avoid administrative rejection of your proposal.

Many of the topics in Section 8 contain references to technical literature or military standards, which may be accessed as follows:

- References with "AD" numbers are available from DTIC, by calling 800/DOD-SBIR or sending an e-mail message to sbir@dtic.mil
- References with "MIL-STD" numbers are available from the Department of Defense Single Stock Point for Military Specifications, Standards and Related Publications at http://stinet.dtic.mil/str/dodiss4_fields.html
- Other references can be found in your local library or at locations mentioned in the reference.

ARMY

PROPOSAL SUBMITTAL

The United States Army Research Office (ARO, reporting to the Army Research Laboratory ARL) manages the Army's Small Business Technology Transfer (STTR) activity. The following pages list topics that have been approved for the fiscal year 2001 STTR program. Proposals addressing these areas will be accepted for consideration if they are received no later than the closing date and hour of this solicitation. Such proposals may be submitted to ARO at either its physical address or its postal address:

Physical Address for Private Delivery Services
U.S. Army Research Office
ATTN: STTR-2001 (Ms. Stowell/Dr. Hurley)
4300 South Miami Blvd.
Durham NC 27703-9142
Telephone: (919)549-4245

Mailing Address for U.S. Postal Service
U.S. Army Research Office
ATTN: STTR-2001 (Ms. Stowell/Dr. Hurley)
P.O. Box 12211
Research Triangle Park NC 27709-2211

The Army anticipates funding sufficient to award one or two STTR Phase I contracts to small businesses with their partner research organizations in each topic area. Awards will be made on the basis of technical evaluations using the criteria contained in the solicitation, within the bounds of STTR funds available to the Army. If no proposals within a given area merit support relative to those in other areas, the Army will not award any contracts for that topic.

Phase I contracts are limited to a maximum of $100,000 over a period not to exceed six months.

Based upon progress achieved under a Phase I contract, a firm may be invited to propose Phase II. Any Phase II contracts following on Phase I proposals submitted under this solicitation will be limited to a maximum of $500,000 over a period of two years. Such Phase II activity will be structured as a single year contract with a one year option.

Army STTR 2001 Topic Descriptions

ARMY01-T001 TITLE: Breathable Clothing Material for Chemical Agent Protection for the Soldier

TECHNOLOGY AREAS: Materials/Processes, Human Systems

OBJECTIVE: Develop a semipermeable membrane coating for clothing that is a barrier to toxins, including chemical agents, while being permeable to water to provide the wearer comfort. This will be accomplished by preparing a permselective coating using reverse microemulsion technology to form a bicontinuous percolating microstructured system.

DESCRIPTION: Defense against weapons of mass destruction is a critical DoD requirement named by the Joint Chiefs of Staff as one of the Ten Future Warfighting Capabilities most needed by U.S. Combatant Commands. It is also critical for the civilian population for civil defense for an effective response in the event of a terrorist attack or an accident. An effective defense requires the development of unique clothing systems that are a physical barrier to toxic vapors, liquids, and aerosols. In addition, the protective material must be permeable to water to reduce incapacitating heat stress, and must be lightweight, flexible, and cost effective. Materials currently in use by DoD are effective barriers to chemical and biological weapons but they produce dangerous heat stress and are bulky, severely reducing maneuverability and the overall effectiveness of the wearer.

This topic will exploit recent research progress in the area of reverse microemulsion technology to solve these problems. This will be accomplished by forming a reverse microemulsion using polymerizable surfactants to produce clusters of water droplets to form a percolating microemulsion (ref. 1). The system will then be polymerized and crosslinked (ref. 2) to impart mechanical stability to form a material that may be tailored for selective permeation and barrier properties. The challenges include choosing materials that will polymerize without disrupting the microstructure (ref. 3) thus retaining permselectivity. Components such as isobutylene are likely candidates that can impart the desired barrier properties without compromising the microstructure. Further, an understanding of how these choices affect bulk properties needs to be fully developed. Although the scientific basis for generating such materials exists, no one has explored the system or application discussed in this topic.

PHASE I: Reverse microemulsions will be prepared using polymerizable surfactants to form coatings with clusters of water droplets creating a percolating microemulsion. In order for the material to be a barrier to toxic compounds, such as chemical agents, it is anticipated that the system will consist of components such as isobutylene or other similar compounds. The system will be polymerized and crosslinked to impart mechanical stability. Phase I will be proof of concept and focus on identifying components and preparing a percolating microemulsion that will produce a mechanically durable and flexible coating that is a barrier to toxic chemicals (chemical agent simulants are one example) while being permeable to water. The material will be characterized with respect to permeation and mechanical properties and the effect of polymerization of the system on these properties will be explored.

PHASE II: Phase II will focus on gaining a full understanding of how to tailor the materials to have targeted properties of interest to DoD and commercial markets. Areas to be explored include phase behavior, polymer molecular weights as a function of their effect on the microemulsion phase diagram, molecular weights as a function of initiator concentration, and the effect of polymerization on properties such as microstructure, permeation, and strength and toughness. In addition the process of coating materials of interest, such as cloth, will be characterized and optimized. During Phase II the investigators will collaborate with the Army to target specific properties and will prepare materials for evaluation by the Army Research Laboratory and the Natick Soldier Center.

PHASE III DUAL USE COMMERCIALIZATION: Materials that are comfortable to wear while protecting the wearer from toxins are critically important to law enforcement and fire fighters, including first responders to chemical and biological attack and chemical accidents. In addition the chemical industry, academe, and the healthcare industry would benefit from protection, such as gloves or full suits that protect against toxins while being breathable.

REFERENCES:

1. "Organic Microporous Materials Made by Bicontinuous Microemulsion Polymerization", J.H. Burban; M. He; E.L. Cussler, AIChE J. 41, 907, 1995.

2. "Polymerization of Tetrahydrofurfuryl Methacrylate in Three-Component Anionic Microemulsions", A.P. Full; J.E. Puig; L.U. Gron; E.W. Kaler; J.R. Minter; T.H. Mourey; J. Texter, Macromolecules, 25, 5157, 1992.

3. "Polymerization of the Inverted Hexagonal Phase", W. Srisiri; T.M. Sisson; D.F. O'Brien; K.M. McGrath; Y. Han; S.M. Gruner, J. Am. Chem. Soc. 119, 4866, 1997.

KEY WORDS: percutaneous protection, permselective membrane, chemical agents, reverse microemulsion, bicontinuous percolating microstructured systems

ARMY01-T002 TITLE: Ultraviolet/Infrared Detectors for Active Protection

TECHNOLOGY AREAS: Information Systems, Sensors

OBJECTIVE: To develop a multicolor detector/sensor that operates in both the solar blind, ultraviolet spectral region and the far infrared spectral region. This combination of spectral regions will enable detection and tracking of kinetic energy projectiles from the initial fire such that an active protection system can be enabled for the Army's Future Combat System.

DESCRIPTION: The Army's Future Combat System will forgo the heavy armor of current treaded vehicles and rely on an active response to avoid being hit by hostile fire. An important element of active protection is the ability to rapidly detect and track an incoming round such that the response system has sufficient time to respond. Over the past five years much improvement has been made in the area of uncooled infrared (IR) sensors as well as sensors in the ultraviolet (UV) spectral region. While a UV detector in the solar blind spectral region (230 – 290 nm) would be useful for active protection due to the lack of clutter in this region, fast photodetectors in a very wide spectral regions are critical here. For a kinetic energy fire, the round is frequently lost in the background of the blast, in both the visible and infrared (IR) spectral regions, but not in the UV region. On the other hand, the IR signal is useful in initial detection of a detonation. The objective of this STTR would be to develop low cost imaging devices that respond to both the IR and the UV. Because of the small time required to detect, track, and reply to an incoming round, it is desirable to have the UV and IR perfectly aligned to avoid time delays required for computational pixel registration. The UV and IR technologies would have to be integrated such that each pixel would be both a UV and IR detector. There are three major tasks involved in this project: 1) Research and fabrication of UV detectors in the solar blind spectral region; 2) research and fabrication of uncooled IR detectors; and 3) schemes to the integration and hybridization of the two detectors in a low cost device that will have the pixel by pixel registration mentioned above. One key to the integration, that may serve for low cost, is the ability to grow on Si substrates. This is a significant challenge in itself due to the large lattice mismatch for most UV detectors and silicon. However, some recently demonstrated progress and further anticipated university contributions should enable this area further. A low cost, dual color sensor with UV and IR spectral bands could become an important component for survivability in future, light weight, highly mobile, tanks and other tactical vehicles.

PHASE I: Determine requirements for active protection and demonstrate feasibility of integration of UV and IR, uncooled detectors.

PHASE II: Demonstrate system quality imaging in separate UV and IR bands. Develop a small imaging, dual color array with integrated pixels.

PHASE III DUAL USE COMMERCIALIZATION: Demonstrate large size (60,000 pixel) imaging array with UV and IR pixels. This detector sensor would also have military applications in general as well as strategic surveillance. Spinoffs from this development, separate UV and IR arrays, would have a plethora of uses including: general surveillance, navigation on the sea, night driving, product analysis, etc.

REFERENCES:

1. E. M. Gullikson, R. Korde, L. R. Canfield, and R. E. Vest, "Stable silicon photodiodes for absolute intensity measurements in the VUV and soft x-ray regions," Journal of Electron Spectroscopy and Related Phenomena 80 (1996) 313-316.

2. E. Monroy, J. A. Garrido, E. Muñoz, I. Izpura, F. J. Sánchez, M. A. Sánchez-García, E. Calleja B. Beaumont, Pierre Gibart, "Characterization and Modeling of Photoconductive GaN Ultraviolet Detectors, MRS Internet J. Nitride Semicond. Res. 2, (1997) 12.

3. M.A. Johnson, Z.H. Yu, J.D. Brown, F.A. Koeck, N.A. El-Masry, H.S. Kong, J.A. Edmond, J.W. Cook, and J.F. Schetzina, "A Critical Comparison Between MOVPE and MBE Growth of III-V Nitride Semiconductor Materials for Optoelectronic Device Applications," MRS Internet Journal of Nitride Semiconductor Research; 4S1(1999)G5.10.

4. G. Xu, X.M. Fang, P.J. McCann, Z. Shi, "MBE growth of wide band gap Pb1-xSrxSe on Si(111) substrate," J. Crystal Growth, 209 (2000) 763-766.

5. W. Radford, M. Ray, R.H. Wyles, J. Wyles, J. Varesi, D. Murphy, a. Kennedy, K. Hay, and J. Finch, "High sensitivity 320x240 (25um pitch) microbolometer FPAs," Proc. 1999 Meeting MSS Specialty Group on Infrared Detectors (1999) 367-376.

KEY WORDS: Uncooled infrared, ultraviolet detectors, solar blind

ARMY01-T003 TITLE: Bioluminescent/Integrated Circuits

TECHNOLOGY AREAS: Chemical/Bio Defense, Biomedical, Electronics

OBJECTIVE: The objective of this topic is to develop a series of genetically engineered microbial tissue-based bioluminescent integrated circuits that will rapidly, quantitatively and selectively detect pathogenic agents such as Bacillus anthracis and Clostridium botulinum.

DESCRIPTION: This approach is based upon the hypothesis that the specificity of phage infection of bacteria can be used to identify, detect, or monitor particular bacterial species. These bioluminescent integrated circuits will be developed by incorporating, for example, bacteriophage-luxI constructs into microbial tissue-based biosensors that, when infected, will stimulate bioluminescence production from a second bacteriological reporter strain. The bacteriophage itself is metabolically inactive, only achieving replicative capabilities upon infection of its specific host bacteria. Since the phage lacks the intracellular machinery to process lux, they remain non-bioluminescent when the target species is absent. However, during a biological event, the phage genes with an accompanying lux construct will be taken up by the host bacterium and transcribed. This will result in an expression of the bioluminescent phenotype in proportion to the concentration of agent with which the tissue-based sensor comes in contact. Immobilization schemes will be developed to affix the engineered bioluminescent microbes to a silicone chip-based integrated circuit to amplify the bioluminescent signal and permit detection of pathogens in air, water, or soil. Sophisticated microelectronic circuitry will be developed and tested for remote monitoring of biosensor chips permitting the sensors to be distributed over large geographic areas to "map" pathogen location, distribution and intensity in real-time. University-based research in this area need be transitioned to an industrial research program.

PHASE I: Phase I will show proof of concept that such a phage infection is both selective for a bacterial species and can generate an appropriate signal. A biosensor based on this approach would consist of two elements; for example, a luxI integrated bacteriophage that specifically infects the pathogen of interest, and a lux-based bioluminescent cell line that responds to the infection event through quorum sensing bioluminescent signal stimulation. Choice of bioluminescent constructs is to be made by the proposer. Bacteriophage pathogen specificity will be used as a means of inducing bacterial tissue-based bioluminescence. The resultant bioluminescent tissue-based biosensor must be assessed for rapidity of response, sensitivity and selectivity of detection for selected pathogenic agents. The engineered bioluminescent cell line must be tested for determination of detection limits, response times, saturation kinetics, and basal expression levels of lux. Both temperate and virulent phage should be tested because it is unknown which phage type will generate optimal responses. Tests utilizing the engineered bioluminescent strain in conjunction with varying concentrations of luxI bacteriophage and associated pathogen will be performed to determine detection limits, response times, saturation kinetics, and background induction.

PHASE II: To adapt bioluminescent integrated circuit technology to wide area biological agent monitoring a single microchip application-specific integrated circuit (ASIC) optical transducer will be developed and produced that couples directly to bioluminescent biosensor matrices to provide a complete, stand-alone detection system. The bioluminescent biosensor whole-cell matrix will be housed in a light tight, metabolically supportive matrix that promotes analyte/biomatrix interaction. The housing must also prevent release of the engineered microbes into the environment. Sensor packaging strategies should be applied to provide for reliable, long term operation of the micro-chip based biologically-active sensing platform in diverse matrices such as air, soil or water.

PHASE III DUAL USE COMMERCIALIZATION: The bioluminescent integrated circuits can be modified and customized to serve as a dual use technology in a diverse number of detection applications. The integrated circuitry permits creation of remotely transmitting distributed networks that can delineate the spread and intensity of biological agents over large geographic areas or provide for placement at critical points in food processing establishments.

REFERENCES:

1. Applegate, B.M., Shingleton, J., Ripp, N., Bright, D., Nivens, D., Simpson, M. and Saylor, G. In: Bioluminescence and Chemiluminescence Perspectives for the 21st Century, A. Roda, M. Pazzagli, L. Kricka and P. Stanley (Editors), 1999.
2. Layton, A.C., Gregory, B., Schultz, T.W. and Saylor, G.S. Ecotox. Environ. Safety, 1999, 43, 222-228.

KEYWORDS: Chemical and Biological Defense, Microsensors, Biosensors, Integrated Circuits, Bioluminescence

ARMY01-T004 TITLE: Remote Sensing and Directed Energy Applications of Femtosecond, Terawatt Lasers.

TECHNOLOGY AREAS: Chemical/Bio Defense, Sensors, Electronics, Weapons

OBJECTIVE: Recent experiments have shown that terawatt, femtosecond laser pulses can propagate up to 12 km in the air. This constitutes a several order of magnitude increase in the propagation distance for high power lasers. The large distance makes possible the development of a new type of remote LIDAR (Light Detection And Ranging) system for the detection of biological and chemical agents at far distances. In addition, these pulses may initiate damage in sensor devices, which could be implemented as counter measures. With current technology, such laser systems can be made compact and man-portable to be

used in the field. However, the long-range propagation phenomenon, which involves the rapid dynamics of the strong interaction of the laser field with the atmosphere, is very new and the underlying physics is not well understood. In order to appropriately tailor and control the propagation, a theoretical physics program is needed for the development of a model that quantitatively describes the phenomenon. In addition, the model needs to be verified both with existing data, and also through experiments directly supporting the above applications.

DESCRIPTION: The long-range propagation in air of intense (~10 GW/cm2), short (<200 fsec) pulses has been a subject of significant interest since its discovery about five years ago. The laser beam self-focuses to a few hundred micrometers in diameter and maintains its power density and temporal structure over long distances. The stable self-channeling prevents optical breakdown. In addition, the strong self-phase modulation produces spectral broadening from the near-UV through the near-IR, and the spectrum exhibits a high, nearly invariant, degree of spectral coherence. Thus, the term "white light laser" has been coined. Because of the high intensity and large propagation distance, the phenomena has great and versatile potential as a novel white light LIDAR and sensor countermeasure. A key aspect of the phenomena is the formation of individual filaments as the initial pulse power is increased beyond a threshold value. The optical filament can form a tight bundle that propagates over long distances. To control the propagation, it is necessary to understand the filamentation and propagation physics in terms of system parameters and initial and boundary conditions.

PHASE I: Develop a physics based numerical and analytical propagation model that includes the strong interaction of the laser pulse with the medium. This should include a verifiable analysis of the detailed transverse instabilities, filamentation, coherence and beam pointing fluctuations as a function of initial conditions such as pulse width, beam radius, wave-front divergence and frequency chirp.

PHASE II: Utilize the understanding of the long-range spatial-temporal dynamical evolution and phase coherence to experimentally demonstrate the applicability of the phenomenon to sensor countermeasures and to remote sensing of chemical and biological agents.

PHASE III DUAL USE APPLICATIONS: The resulting model and experimental verification will serve as the foundation for novel LIDAR systems for remote detection of atmospheric chemicals and aerosols for pollution monitoring, and for the remote measurements of atmospheric turbulence for improved wind-shear alerts for landing aircraft.

REFERENCES:

1. N. Akozbek, C. Bowden, A. Talepour and S. Chin, Phys. Rev. E 61, 4540 (2000).
2. N. Akozbek, C. Bowden, A. Talepour and S. Chin, Laser Physics, 10, 101 (2000).
3. A. Braun, G. Korn, X. Liu, D. Du, J. Squier, and G. Mourou, Opt. Lett. 20, 73 (1995).
4. Uwe Brinkmann, Laser Focus World, 35, November (1999).

KEY WORDS: Long-range femtosecond laser propagation; ultrashort laser pulse propagation; white-light laser; remote chemical/biological agent detection

ARMY01-T005 TITLE: Bioengineered Proteins for Chemical/Biological Defense, Protection, and Decontamination

TECHNOLOGY AREAS: Chemical/Bio Defense, Human Systems

OBJECTIVE: To develop an innovative, very high yield system for the production of unmodified recombinant proteins for use in chemical/biological (CB) decontamination and protection regimens, CB detection devices, and in the production of specially bioengineered protein-based materials for applications in bioinformatics, nanostructures, etc.

DESCRIPTION: Numerous applications are being developed for proteins that have been engineered for specific biological or physical properties. The specificity of enzyme proteins in destroying or modifying various CB threats make them ideal choices for utilization in detection, protection, and decontamination devices. While the versatility and utility of such proteins is widely recognized, there are severe constraints in the production of the genetically modified proteins. Most protein production systems currently use laboratory "friendly" organisms that were selected not because of their utility in scaled-up fermentation processes but because they were convenient organisms for which there was much laboratory experience in their genetic and growth characterizations. This STTR seeks innovative and creative approaches to develop a high yield gene expression system that would allow the production of abundant amounts of bioengineered proteins under simple and comparatively inexpensive culturing conditions. This would generate adequate supplies of specialized proteins for utilization in CB defense and in the construction of protein-based biomaterials.

PHASE I: This effort will focus on the analysis of systems that have the capabilities for producing high levels of proteins under minimal growth conditions in industrial-scale fermentations; e.g., yeast, fungi, bacteria, plants, and animal cultures. A successful Phase I will investigate and demonstrate approaches in the university and small business community that could be used for producing high protein yields and genetic constructions for recombinant proteins into those organisms. Protein yields, stability of the introduced genes, ease of preparation of proteins and cost of production of the proteins would all be factors to determine a suitable high-volume recombinant gene expression system.

PHASE II: The small business should implement the scale-up of the culture system and yields of model recombinant proteins. Calculations of the cost of the high-yield proteins should be made to affirm the utility of the model system. Recommendations for the optimal cultural conditions should also be made.

PHASE III DUAL USE APPLICATIONS: The system to be developed would significantly impact the development of devices for CB and nanotechnological applications and biomaterials for military applications, as well as a myriad of civilian, industrial and medical applications. Proteins that could be produced by the system include organophosphate-degrading enzymes for protection and decontamination, biochemical sensors, and very high purity blood proteins for remediating massive exsanguination.

OPERATION AND SUPPORT COST (OSCR) REDUCTION: Operating and Support Costs (O&S) would be favorably impacted by this technology. A high-yield fermentation for bioengineered proteins would allow the current protein-based systems to be replaced by cheaper and more efficient protein expression systems. Furthermore, with the availability of abundant amounts of genetically modified proteins numerous other military and civilian applications would be accelerated.

REFERENCES:

1. Rozkov, A., and Envors, S-O. 1999. Stabilization of a proteolytically sensitive cytoplasmic recombinant protein during transition to downstream processing. Biotechnol. Bioeng. 62, 730-738.
2. Mukhopadhyay, A. 1997. Inclusion bodies and purification of proteins in biologically active form. Adv. Biochem. Eng./Biotechnol. 56, 61-109.
3. Vieth, W.R. 1994 Bioprocess engineering. J. Wiley and Sons.
4. Shuler, M.L., and Kargi, F. 1992. Bioprocess engineering. Prentice Hall.

KEYWORDS: Microbial high-yield protein systems; bioengineered proteins; recombinant proteins; protein purification.

ARMY01-T006 TITLE: Multiband Fluorescence Imaging for Wide Area Detection of Land Mines, Unexploded Ordnances, and Other Contaminants

TECHNOLOGY AREAS: Chemical/Bio Defense, Sensors, Battlespace

OBJECTIVE: Airborne Real-time Detection of Unexploded Ordnance/TNT Contaminated Areas by Enhanced Multiband Fluorescence Imaging.

DESCRIPTION: The detection of unexploded ordnance (UXO) and land mines is a major concern for ground forces. In addition, mandated clean up and reclamation of military bases requires a robust method to detect contaminants related to buried UXO material. Recent laboratory testing has shown that laser-induced fluorescence technology was successful in the detection of fluorescence emissions related to secondary explosives (i.e., TNT), where photoluminescence was enhanced through the use of genetically engineered microbes. A multiband fluorescence imaging system incorporating specific broad-band excitation and emission capabilities could expand the utility of the technology and broaden the range of detectable UXO constituents including metals-based primary explosives, and other target materials. It is envisioned that a fully operational system will be aircraft mounted for use over large, potentially hazardous areas.

PHASE I: Demonstrate the feasibility of using fluorescence information to enable detection of TNT, UXO, or other contaminants. Possible excitation sources could include, but is not limited to, lasers, flashlamps, and solar energy (through use of Fraunhofer lines). The fluorescence signal may be enhanced/modified by (again not limited to), microbes, vegetation, polymers, and chemical compounds. Investigate parameters such as target material uptake/reaction time, optimal excitation wavelength, fluorescence signal strength, and spectral separation from backgrounds.

PHASE II: Develop a "benchtop" prototype system, including excitation source, fluorescence enhancing material (i.e., microbes, vegetation, etc.), and detection hardware. Demonstrate, through laboratory and limited field testing, that the fluorescence signal obtained from the desired material is detectable and separable from background features. Identify and address system scaling issues that will allow for the transition of this technology to an airborne platform.

PHASE III DUAL USE COMMERCIALIZATION: Develop a prototype airborne delivery and detection system capable of covering approximately 100 acres per day/night. Conduct testing to prove the feasibility of using this system in multiple environments. Develop a prototype hardware and software system to perform image processing, mosaic construction, signature matching, and Geographic Information Systems (GIS) overlays.

It is envisioned that multiple civilian/commercial uses of this technology exist. An airborne fluorescence imaging system (especially in combination with enhanced fluorescence techniques) could be applied towards industrial waste (e.g. heavy metals, toxins, etc.), detection, mapping, and cleanup. Possible additional uses could include detection of chemical/biological weapons byproducts, agricultural monitoring, and both aquatic and terrestrial petroleum spills.

REFERENCES:

1. Fischer, R.L., R.S. Burlage, J. DiBenedetto, and M.J. Maston. 2000. Using Fluorescence Imagery and Microbes for Ordnance and Mine Detection. Army AL&T, PB-70-00-4, 10-12.

2. Burlage, R.S., R.L. Fischer, J. DiBenedetto, and M.J. Maston. 2000. Reporter Gene System for the Field Detection of Explosives. Second International Symposium on Biotechnology for Conservation of the Environment, July 9-12, 2000, Munster Germany.

KEY WORDS: TNT, UXO, land mines, laser induced fluorescence, spectral signatures

ARMY01-T007 TITLE: Telemedicine and Advanced Medical Technology - Medical/Surgical, Mission Support Modeling, and Simulation

TECHNOLOGY AREAS: Biomedical, Human Systems

OBJECTIVE: To advance develop and demonstrate a computer-based, central venous catheterization (CVC) simulation system for training of military far-forward care providers and emergency responders. The implementation of this technology should enable the Department of Defense (DoD) to provide improved medical support to the wounded soldier through enhanced medical training with improved diagnosis, rehearsal, and treatment planning. The CVC system falls into a category of "virtual workbench" type simulators currently sought by DoD medical trainers

DESCRIPTION: Objective force concepts of operation require sustenance and enhancement of the quality of medical care, which includes ensuring the currency of the skills of medical care providers. Thus, there is a need to develop a CVC simulation system to provide the visual and tactile fidelity necessary for combat care training. The objective of creating a computer simulated virtual environment for medical training is to provide a level of training not possible using traditional methods. Traditional techniques for teaching trauma procedures have depended largely on the existence of a sufficiently large number of proctors with adequate skills to teach trauma procedures. Other approaches include practice on animals, but animal models of injury often do not reflect human trauma, and raise a host of ethical issues concerning procuring and maintaining animals for training. Also, practice on humans and animals precludes the ability to repeatedly rehearse specific components of the procedure that may prove challenging or require finely tuned motor skills. An additional concern is that Department of Defense (DoD) hospitals are usually not regional trauma centers, so that physicians and allied health personnel in the military may not obtain significant exposure to human trauma cases for training purposes.

PHASE I: Describe concept and design a realistic advanced prototype of a CVC Simulation system, based on a complete task analysis to be conducted. All technical components for CVC simulation have demonstrated feasibility, including:

1. Development of a prototype haptic feedback interface device
2. Refinement in computer modeling technology
3. Development of educational content design document
4. Medical Simulation Software Architecture

The development of a haptic feedback interface device is critical to a realistic medical simulation. A device to simulate the needle stick, vein location, and catheter navigation has been designed and prototyped but requires field evaluation. Significant refinement is needed in computer modeling technology for internal jugular and femoral vein central venous access. The need for development of educational content includes skin stretch via the interaction device, patient feedback (pain sounds, hematoma, etc.), and "drag and drop" application of, for example, topical application of antiseptics and anesthetics. Hardware and software developmental needs include a second generation device that will accept the longer central line used in CVC and .the design of a CVC module that can be used for training, skills maintenance, and measurable quality improvement.

PHASE II: Develop and demonstrate a functional prototype of a full performance CVC simulation system. These efforts should include: a) development of a prototype haptic feedback interface device; b) refinement in computer modeling technology; c) development of educational content design document; and d) development of medical simulation software architecture.

PHASE III DUAL USE COMMERCIALIZATION: This CVC simulation system is applicable to military and civilian tactile task training. Additionally the CVC simulation workstation system will be a powerful intermediate in the path toward Total Immersive Virtual Reality training.

REFERENCES: "Operational Capability Elements: Joint Medical Readiness," Page 6 (section 3.2.1), Joint Science and Technology Plan for Telemedicine (submitted to and approved by the DDR&E, 1 October 1997) - Chapter IV (section F), Joint Warfighting Science and Technology Plan (1997)

KEY WORDS: Modeling and simulation, medical skills training, individual and unit training, medical force readiness, mission rehearsal, CVC simulation, haptics, force feedback, tactile training.

ARMY01-T008 TITLE: Novel Assessment Tools for Empirical Determinants of Direct Leadership

TECHNOLOGY AREAS: Biomedical, Human Systems

OBJECTIVE: To create novel assessment tools and new empirical technologies for determining all sources of direct leadership effectiveness in a real world setting.

DESCRIPTION: Bold, innovative leaders of character and competence are fundamental to the long-term health of the Army. In the Objective Force of 2015-2020, relatively junior leaders will be faced with a much broader scope of responsibilities than has been true in the past. Companies may be deployed on their own, and company commanders will therefore need to be able to command on their own. At all levels in the Army we will need bold, innovative leaders with the skills and ability to do things right and the knowledge, wisdom, maturity, values, and judgment to do the right thing. But especially at lower levels, we will need to develop these leaders very quickly, and then provide the safety net to support them as they face their daunting challenges. The key to the development of direct leadership capabilities is the ability to measure leadership behavior in an objective fashion and ultimately to relate it to predictive personnel attributes, how they change with experience, and how easy or difficult they are to change. New internet based technologies for communicating, sharing experiences and decisions, and analyzing complex text databases provide novel approaches to observing leadership decision making and performance in the field. To begin the effort of creating novel assessment tools for measuring leadership development, the Army Research Institute (ARI) and the United States Military Academy (USMA) created a Baseline Officer Longitudinal Data Set (BOLDS) in which cadets were tracked over the course of their 4-year USMA developmental experience on multiple instruments and performance ratings. (c.f. http:///www.dean.usma.edu/bsl/bolds.htm). Results from this database will be made available to the researchers to assist their development of new empirical measures of actual leadership performance in the field. However, now that these officers have moved into the field, novel assessment tools for measuring leadership performance must be developed, using new technologies arising from the internet and new psychological theories of emotional intelligence and tacit knowledge, that go beyond paper and pencil tests. The purpose of this new effort will be to create and validate empirical technologies for objectively measuring and assessing the direct leadership effectiveness of officers as they progress through early leadership experiences in the Army. From this, an overarching framework will be created for understanding and developing leadership in many different military and industrial settings.

PHASE I: Develop a battery of novel, objective, direct leadership assessment tools that can be applied in a real world setting and justify them using an acceptable theoretical framework. This battery must provide for direct predictions of performance that can be observed and measured in junior officer leadership positions at the level of Army squad, platoon, company, or battery. It must incorporate new technologies for collecting and observing leadership performance directly, provide for sharing experiences and communication on internet sites like www.Companycommand.com and www.Platooncommand.org, and be capable of sophisticated text analysis of such communication. It must also incorporate the latest psychological insights into leadership attributes, such as emotional intelligence and tacit knowledge. The Phase I proposal must describe in detail the approach to the creation of this novel assessment tool battery, the development of a sampling plan and kinds of data to be collected to accurately describe the leadership effectiveness of individual officers in the field. The range of influences to be incorporated into the framework and of the data to be collected with the set of novel assessment tools shall include at a minimum individual characteristics, interpersonal skills and behavior, organizational characteristics and behavior, and led-unit outcome measures.

PHASE II: Using the planning and theoretical products of Phase I, develop the full battery and validate its development using an Army population to be selected by ARI.

PHASE III DUAL USE COMMERCIALIZATION: Accurately measuring the determinants and all sources of direct leadership effectiveness through novel assessment tools has broad potential use throughout DoD military and civilian organizations; in every sort of industry; and in a broad array of occupations from teachers and school principals to chief executive officers of commercial enterprises.

REFERENCES:

1. Bartone, P.T. (1999). Hardiness protects against war-related stress in Army reserve forces. Consulting Psychology Journal, 51 (2), 72-82.
2. Goleman, D. (1998) Working with emotional intelligence. New York: Bantam Books.
3. Sternberg, R.J., Forsythe, G.B., Hedlund, J., Horvath, J. A., Wagner, R.K., Williams, W.M., Snook, S., & Grigorenko, E.L. (2000). Practical intelligence in everyday life. New York: Cambridge University Press.
4. Zaccaro, S. J., Klimoski, R. J., Boyce, L. A., Chandler, C., & Banks, D. J. (1999). Developing a toolkit for the assessment of Army leadership processes and outcomes: Version 1.0 (ARI Research Note 99-35). Alexandria, VA: U.S. Research Institute for the Behavioral and Social Sciences. (DTIC Number AD A368).

KEY WORDS: Direct Leadership; 360 Assessment; Command Climate; Lieutenants; Captains; Platoons; Company; Personality; Knowledge; Skills; Tacit Knowledge; Hardiness; Commitment; Azimuth; Problem Solving; Interpersonal Skills; Baseline Officer Longitudinal Data Set (BOLDS); Emotional Intelligence.

ARMY01-T009 TITLE: High Resolution Electromagnetic and Thermal Mapping of Radio Frequency Components

TECHNOLOGY AREAS: Information Systems, Sensors, Electronics

OBJECTIVE: To provide the capability to map the transient electromagnetic near field around large, complex radio frequency (RF) circuits, in correlation with the transient temperature field, in order to obtain knowledge about the actual circuit interactions for purposes of physical understanding of the complex circuit interactions, design information, and diagnostic indications.

DESCRIPTION: As RF circuits become more complex, with electromagnetic structures such as antenna elements, filters, inductors, etc., closely integrated with nonlinear, active devices such as diodes and transistors, the coupling of the active devices through unanticipated electromagnetic paths has become a serious design problem. This is particularly true for large active antenna arrays found in spatially or quasi-optically combined systems. In addition, RF power circuits are beginning to show that the temperature variation across a circuit can have a large effect on performance, not only at relatively long time scales, but in some cases at time scales which cause interference with the baseband modulation frequency band. Recent government sponsored university research has demonstrated highly effective electromagnetic mapping approaches using a variety of electro-optic and microwave techniques. By itself this EM mapping of the operating circuit has played a critical role in understanding the physical processes occurring in complex RF structures and in diagnosing circuit problems. Other government sponsored university research has demonstrated the effectiveness of thermal mapping of RF circuits in operation in diagnosing device and circuit behavior as revealed by the time dependence of temperature differences at high resolution. (See the references below for examples). The ability to correlate the information from the time dependence of the near EM field with the transient temperature distribution, at high resolution across the RF circuit, is expected to provide a new level of circuit understanding and design information. The electromagnetic imaging would be required at finer resolution than a wavelength for circuits operating from hundreds of MHz to 100 GHz. The electromagnetic field must be imaged in all 3 vector components and in amplitude and phase. The thermal imaging must be capable of the same or finer resolution than the electromagnetic imaging. The electromagnetic probe should be noninvasive, and both the thermal and electromagnetic imaging systems must not interfere with each other. The system must be capable of imaging large arrays of antenna elements integrated directly with active devices and circuits as well as smaller, but complex RF circuits. The university contribution is to provide the research expertise in the fields of the mapping technology and the interpretation of the mapped images, to configure a laboratory prototype to provide a model for commercial implementation, and to provide the interpretation of correlated imaging results and algorithms to use in the commercial diagnostic software.

PHASE I: Demonstrate the feasibility of the combined EM and thermal transient imaging capability and show what new types of circuit phenomena can be inferred from the resulting data.

PHASE II: Design a system demonstration for testing which is appropriate as a basis to commercialize a cost effective, marketable system for commercial and military applications.

PHASE III DUAL USE COMMERCIALIZATION: Such a unique RF circuit diagnostic tool will directly impact the product cost and size of RF systems by enabling the characterization of early design concepts, the fast identification of design problems, and the high resolution determination of circuit areas requiring reduced RF component separation (resulting in denser circuit layout). This will impact commercial cellular electronics, radar, and millimeter wave communications and target acquisition systems, military and commercial. The product to be marketed is the diagnostic mapping tool itself, with the potential market being companies designing RF products and systems.

REFERENCES:

1. K. Yang, L.P.B. Katehi, and J.F. Whitaker, "Electro-optic field mapping system utilizing external gallium arsenide probes," Appl. Phys. Lett., vol. 77, pp. 486-488 (Jul. 2000)

2. E.C. Landahl, et. al., "Phase Noise Reduction and Photoelectron Acceleration in a High Q RF Gun, IEEE Trans. on Plasma Science, vol. 26, no. 3 (Jun 1998)

3. R.G. Johnson, W. Batty, A.J. Panks, and C.M. Snowden, "Fully Physical Coupled Electro-Thermal Simulations and Measurements of Power FET's," in 2000 IEEE MTT-S International Microwave Symposium Digest, pp. 461-464,

4. T.P. Budka, S.D. Waclawik, and G.M. Rebeiz, "Near Electric Field Mapping Above X-Band MMIC's Using Modulated Scattering," IEEE MTT-S International Microwave Symposium Digest 1997, pp1703-1706.

KEY WORDS: Near field electromagnetic imaging, thermal circuit imaging, Radio Frequency circuit diagnostics.

NAVY STTR
PROPOSAL SUBMISSION

INTRODUCTION:

The responsibility for the implementation, administration and management of the Navy STTR program is with the Office of Naval Research (ONR). The Navy STTR Program Manager is Mr. John Williams, (703) 696-0342. All STTR Phase I and Phase II proposals, Phase I and II printed electronic summary reports, as well as Phase III success stories should be forwarded to Mr. Williams at the address below. If you have any questions, problems following the submission directions, or inquiries of a general nature, contact Mr. Williams. An original and four (4) copies of the Phase I proposal are due by **11 April 2001** and must be submitted to:

U.S Mail packages send to:

Office of Naval Research
ONR 364 SBIR
Ballston Tower #2, Room 106
800 North Quincy Street
Arlington, VA 22217-5660

Overnight Mail Services or Courier packages send to:

Office of Naval Research
ONR 364 SBIR
Ballston Tower #2, Room 106
801 North Randolph Street
Arlington, VA 22203

YOUR SUBMISSION TO THE NAVY STTR PROGRAM:

This solicitation contains a mix of topics. When preparing your proposal keep in mind that Phase I should address the feasibility of the solution to the topic. Phase II is the demonstration of the technology that was found feasible in Phase I. Only those Phase I awardees which have been **invited** to submit a Phase II proposal by the Navy technical point of contact (TPOC) or the STTR program manager during or at the end of a successful Phase I effort will be eligible to participate for a Phase II award (with the exception of Fast Track Phase II proposals per section 4.5). If you have been invited to submit a Phase II proposal, obtain a copy of the Phase II instructions from the Navy SBIR/STTR Webpage at: **http://www.onr.navy.mil/sbir** under submission. All Phase I and Phase II proposals should be sent to the Navy STTR Program Office at the above address for proper processing. Phase III efforts should also be reported to the STTR program office noted above.

The Navy will provide potential awardees the opportunity to reduce the gap between Phases I and II if they provide a $70,000 maximum feasibility Phase I Base proposal and a fully costed, well defined $30,000 maximum Phase I Option. **The Navy will not accept Phase I proposals in excess of $70,000 (exclusive of the Phase I option).** The technical period of performance for the Phase I Base effort should be 6 months and for the Phase I option should be 3 months. The phase I proposal with the option will adhere to the 25 page limit (section 3.3). The Phase I Option should be the initiation of the next phase of the STTR project (i.e. initial part of Phase II), and it must be included with the Phase I proposal. Please include brief task statements and milestones for the Phase I option, and include the costs on the same Appendix C, but in a separate column.

The Navy will evaluate and select Phase I proposals using scientific review criteria based upon technical merit and other criteria as discussed in this solicitation document. Due to limited funding, the Navy reserves the right to limit awards under any topic and only proposals considered to be of superior quality will be funded. The names of firms whose proposals have been selected for further consideration will be posted by topic number on the Navy SBIR/STTR website, under "What's New" within 3 months of the proposal deadline. In addition, the abstracts of companies that have received Phase I awards will be posted on the website within 5 months of the proposal deadline.

Phase I awardees should submit a 5-page preliminary plan for Phase II to the Navy STTR Program Manager at the address above, 6 months after contract award. However, only those Phase I awardees which have been invited to submit a formal Phase II proposal will be eligible for a Phase II award (with the exception of Fast Track Phase II proposals per section 4.5). If you have been invited to submit a Phase II proposal, get a copy of the Phase II proposal preparation and submittal guidelines from the Navy SBIR/STTR website.

When you submit a Phase II proposal it should consist of three elements: 1) a $400,000 maximum demonstration phase of the STTR project; 2) a separate 3 to 5 page transition/marketing plan describing how, to whom and at what stage you will market your technology to the government and private sector; and 3) a Phase II Option ($100,000 maximum) which would be a fully costed and well defined section describing additional R&D or test and evaluation to assist in the transition of the technology. You must also submit your Phase II Proposal Cover Sheet, Commercialization Report, and Transition/Marketing plan

electronically over the Internet at **http://www.onr.navy.mil/sbir**. Phase II proposals together with the Phase II Option are limited to 40 pages (unless otherwise directed by the TPOC or contract officer). The Transition/Marketing plan must be a separate document that is submitted through the Navy SBIR website under "Submission" and included with the proposal hard copy.

NAVY REQUIREMENTS:

1. The Navy requires a DoD Proposal Cover Sheet (formerly Appendix A & B) to be submitted electronically through the Navy SBIR website or DoD SBIR website at **http://www.dodsbir.net/sbirsubmission**. *The company must print out the forms directly from the website, sign the forms and submit them with their proposal.* If you have any questions or problems with the electronic submission contact the DoD Helpdesk at 1-800-382-4634. Submit electronic Internet forms early. As the deadline for proposal submission approaches, computer traffic increases slowing down computer speed. **Do not wait until the last minute.**

2. The Navy only accepts Phase I proposals with a base effort not exceeding $70,000 and with the option not exceeding $30,000. The Phase I base effort should run about 6 months and the option 3 months.

3. All Phase I award winners must electronically submit a Phase I summary report through the Navy SBIR website at the end of their Phase I.

4. Phase II award winners must also submit Phase II summary reports through the Navy SBIR website.

NEW NAVY REQUIREMENTS:

1. All Phase II proposals must have a Proposal Cover Sheet and Commercialization Report submitted through the DoD SBIR website and a Transition/Marketing plan submitted through the Navy SBIR website.

2. All Phase II award winners must attend a two day Commercialization Assistance/Business Plan Development Course from the Navy. This is typically taken at the beginning of the 2nd year of the Phase II.

ADDITIONAL NOTES:

1. The Small Business Administration (SBA) has made a determination that will permit the Naval Academy, the Navy Post Graduate School and the other military academies to participate as a Research Institution in the STTR program, since they are institutions of higher learning.

2. The Navy will allow firms to include with their proposals success stories that have been submitted through the Navy SBIR website at **http://www.onr.navy.mil/sbir**. A Navy success story is any follow-on funds that the firm has received from a past Phase II Navy SBIR or STTR award. The success story should then be printed and included as appendices to the proposal. These pages will not count towards the 25-page limit. The success story information will be used as part of the evaluation of the third criteria, Commercial Potential (listed in Section 4.2 of this solicitation) which includes the Company's Commercialization Report (formerly Appendix E) and the strategy described to commercialize the technology discussed in the proposal. The Navy is very interested in companies that transition SBIR/STTR efforts directly into Navy and DoD programs and/or weapon systems. If a firm has never received a Navy SBIR/STTR Phase II it will not count against them.

3. Effective in Fiscal Year (FY) 2000, a Navy activity will not issue a Navy STTR Phase II award to a company when the elapsed time between the completion of the Phase I award and the actual Phase II award date is eight (8) months or greater; unless the process and the award has been formally reviewed and approved by the Navy STTR Program Manager. Also, any STTR Phase I contract that has been extended by a no cost extension beyond one (1) year will be ineligible for a Navy STTR Phase II award using STTR funds.

4. The Navy has adopted a New Phase II Enhancement Plan to encourage transition of Navy STTR funded technology to the Fleet. Since the Law (PL102-564) permits Phase III awards during Phase II work, the Navy will provide a 1 to 4 match of Phase II to Phase III funds that the company obtains from an acquisition program. Up to $250,000 in additional STTR funds can be provided as long as the Phase III is awarded and funded during the Phase II.

5. The Navy typically provides a firm fixed price contract or awards a small purchase agreement as a Phase I award; and a cost plus fixed fee or an Other Transition Agreement (OTA) as a Phase II award. The type of award is at the discretion of the contracting officer.

NAVY FAST TRACK DATES AND REQUIREMENTS:

The Fast Track application must be received by the Navy 150 days from the Phase I award start date. Any Fast Track applications received thereafter may be declined. All Fast Track applications and required information must be sent to Navy STTR Program Manager at the address listed above and to the designated Contracting Officers Technical Monitor (the Technical Point of Contact (TPOC) for the contract). The dates and information required by the Navy are the same as the dates and information required under the DoD Fast Track described in the front part of this solicitation.

PHASE I PROPOSAL SUBMISSION CHECKLIST:

All of the following criteria must be met or your proposal will be REJECTED.

____1. The DoD Proposal Cover Sheet (formerly Appendix A & B) and the DoD Commercialization Report (formerly Appendix E) have been submitted electronically over the Internet through the submission site.

____2. The Cover Sheet has been printed directly from website, signed, and is the first page of the proposal.

____3. The Company Commercialization Report has been submitted electronically, printed, signed and attached to the back of the original and each copy of the proposal. This report is required even if the company has not received SBIR/STTR funding.

____4. The Phase I proposed cost for the base effort does not exceed $70,000. The Phase I Option proposed cost does not exceed $30,000. The costs for the base and option are clearly separate and identified on the Proposal Cover Sheet, in the signed cost proposal, and in the work plan section of the proposal.

____5. An original and 4 copies of the proposal must be received on or before 11 April 2001. The Navy will not accept late or incomplete proposals.

NAVY FY01 STTR TITLE INDEX

N01-T001	Autonomous Distributed Systems
N01-T002	Marine Mammal Detection and Mitigation
N01-T003	Outfitting Attachment Systems For Composite Sandwich Structure
N01-T004	Reconfiguration of Component Level Control Network Automation Systems
N01-T005	Oxygen Source for Underwater Vehicle Fuel Cells
N01-T006	Reduced Flammability Vinyl Ester Resin Containing no Halogens for Use in Large Composite Ship Surface Structures via Nanocomposite Technology
N01-T007	Low Cost Composite Manufacturing of Large Scale Hydrodynamic Surfaces
N01-T008	Microbubble Drag Reduction Demonstration
N01-T009	Permanent Magnets with Improved Mechanical Properties for Propulsion
N01-T010	Advanced Fluid Modeling Capability for Underwater Shock Analysis of Naval Platforms

Navy STTR 2001 Topic Descriptions

N01-T001 TITLE: Autonomous Distributed Systems

TECHNOLOGY AREAS: Sensors, Electronics, Battlespace

DOD ACQUISITION PROGRAM SUPPORTING THIS TOPIC: FNC: Autonomous Operations

OBJECTIVE: The objective is to develop and demonstrate innovative hardware and software to enable advanced networked, autonomous, distributed systems of sensors for surveillance and measurement of the oceanic littoral environment. Sensor platforms may be fixed or mobile. The approach should be based on innovative solutions, not integration of off-the-shelf technology.

DESCRIPTION: Platforms of interest are: fleets of autonomous underwater vehicles (AUVs) sampling ocean state variables and sound speed gradients or searching for mines adaptively to minimize measurement and location error; flocks of unmanned arial vehicles performing coastal surveillance or measuring wind speed and direction; packs of crawling robots exploring the ocean floor for mines or measuring the bottom properties; fields of fixed sensors detecting and tracking submarines and surface ships for surveillance and cooperative engagement. Autonomous here means that the units of the distributed system are not mechanically linked by communication or power cables. Typical network-class AUVs of interest are less than 200 kg in air, have a maximum speed less than 250 cm/s, can be configured to operate at full ocean depth, may be propeller, buoyancy, or fin driven, and have ranges greater than 500 km. Concepts of interest include: methods of extracting power from the environment; high bandwidth, matched acoustic and radio frequency communication devices; micro and MEMS-based sensors; tagging devices; compact packaging and deployment methods; fault tolerant network routing; distributed intelligence and control algorithms; dynamic sampling and field/target estimation methods based on fusion of global and local data. Proposals based on small, low cost, low power, modular, robust vehicles and sensors will be weighted highly.

PHASE I: The proposed concept will be designed and analyzed with particular attention to trade-offs.

PHASE II: Fabrication, testing and evaluation of a prototype will be accomplished. Cost trade-offs in production quantities should be analyzed.

PHASE III: Transition to a funded government or commercial program will be accomplished.

DUAL-USE POTENTIAL: Commercial applications include environmental modeling and prediction, satellite ground truth, marine salvage and fisheries management. The many industries associated with these activities will benefit, and this technology will likely spawn new industries.

REFERENCES:

1. Curtin et al., 1993. Autonomous Oceanographic Sampling Networks. Oceanography, 6(3): 86-94.
2. Roy, T., J. Bekkedahl, M. Hogue, M. Mayekawa, S. Hobbs, J. Herman, M. Howard, "Signal Processing and Data Fusion for Deployable Autonomous Distributed Systems", SSC SD TR-1796, March 1999, SPAWAR Systems Center, San Diego, CA
3. Roy, T., "Autonomous Off-Board Surveillance Sensors (AOSS) Technology Demonstration Project – FY98 Progress Report", SSC SD TR-1794, March 1999, SPAWAR Systems Center San Diego
4. M. Owen, P. Shea, "A Modular Fusion Architecture for Maritime Surveillance", 1999 IRIS National Symposium on Sensor and Data Fusion, 24-27 May 1999
5. Green, M. D., J. A. Rice and S. Merriam, "Underwater Acoustic Modem Configured for Use in a Local Area Network", Proc. IEEE OCEANS '98 Conf., Vol. 2, pp. 643-638, Nice France, September 1998

KEYWORDS: Autonomous; Sensors; Underwater; Littoral; Lightweight; Surveillance; Ultra-Low Power; Acoustic Communications

N01-T002 TITLE: Marine Mammal Detection and Mitigation

TECHNOLOGY AREAS: Sensors, Electronics, Battlespace

DOD ACQUISITION PROGRAM SUPPORTING THIS TOPIC: FNC: Littoral Antisubmarine Warfare

OBJECTIVE: Enable the development of systems that will automatically detect marine mammals that may be affected by ships at sea. Develop decision aids that will guide mitigation of effects on marine mammals once detected.

DESCRIPTION: The detection of marine mammals and mitigation of effects on them during naval and commercial operations at sea is necessary in order to comply with the laws and policies which apply to marine mammals and endangered species. At present, human observers are ordinarily used to detect marine mammals at sea. Detection of distant distributions, night-time detection, detection of submerged animals and continuity and consistency of observation are problems which cannot be solved using human observers. Possible detection systems of interest are: acoustic for detection of submerged animals; radar detection of distant distributions; optical or infrared for detection of near surface or surfaced animals. All systems must work automatically with high probability of detection and low false alarm rate. Decision Aids for mitigation of effects should take into account known behavior of marine mammals and the known handling characteristics of the ships.

PHASE I: The detection and mitigation system will be designed.

PHASE II: A prototype of the system will be constructed and shown to be feasible

PHASE III: Transition to commercial and military use will occur. Expected transition targets are the commercial oil shipping companies and the naval Anti-Submarine Warfare (ASW) community.

DUAL-USE POTENTIAL: All commercial shipping is subject to the laws and policies designed to protect marine mammals and endangered species. Commercial shipping is currently the largest killer of some endangered marine mammals. Freight and oil shipping companies are expected to benefit from the systems developed under this STTR

REFERENCES:

1. OPNAVINST 5090.1B, (02 FEB 1998)
2. SECNAVINST 5000.2B (06 DEC 1996)
3. "Marine Mammals and Noise", W. J. Richardson, C. R. Greene, C. I. Malme, D. H. Thomson, Academic Press, 1955
4. "Marine Mammals and Low-Frequency Sound: Progress Since 1995", National Research Council, Naitonal Academy Press, 2000
5. "Infrared Imaging Systems: Design, Analysis, Modeling and Testing VII", Holst, Gerald C. (ed.), Proceedings/SPIE—the International Society for Optical Engineering, v. 2743, 10-11 April 1996, Orlando FL
6. "Infrared Imaging Systems: Design, Analysis, Modeling and Testing VI", Holst, Gerald C. (ed.), Proceedings/SPIE—the International Society for Optical Engineering, v. 2470, 19-20 April 1995, Orlando, FL.
7. "Sensors, Cameras and Applications for Digital Photography", Sampat, Nitin (ed.), Proceedings/SPIE—the International Society for Optical Engineering, v. 3650, 27-28 January 1999, San Jose CA
8. "Cameras and Systems for Electronic Photography and Scientific Imaging", Anagnostopoulos, Constantine N. (ed.), Proceedings/SPIE—the International Society for Optical Engineering, v. 2416, 8-9 February 1995, San Jose CA

KEYWORDS: Marine Mammals; Automatic; Acoustic; Optical; Infra-Red; Radar; Decision Aids; Mitigation

N01-T003 TITLE: Outfitting Attachment Systems For Composite Sandwich Structure

TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes

DOD ACQUISITION PROGRAM SUPPORTING THIS TOPIC: FNC: Platform Protection

OBJECTIVE: Develop a system for reliably and inexpensively attaching medium to heavy weight equipment to thin-skin composite sandwich structure.

DESCRIPTION: The US Navy is utilizing or considering the use of composite sandwich materials for a variety of ship topside and hull structures. A common issue with each of these applications is the method by which equipment can be mounted to the composite panels. The desire is to introduce a single standard system that can be scaled to fit the weight of the outfitting item. The exact location of pipes, cable hangers, control boxes and other equipment is typically not specifically located when sandwich panels are fabricated. Therefore, approaches that use pre-located inserts or local core densification are not acceptable. The desired system should fit into a shipyard production environment as well as withstand the extreme environmental and combat conditions of a Navy warship.

Composite panels for Navy marine topside sandwich structures tend to optimize with relatively thin facesheets (0.10" to 0.50" for typical US Navy applications) consisting of either glass or carbon reinforced plastic composites over a balsa or foam core. Current attachment approaches include self-tapping screws, adhesive bonding, and through-bolting. Each of these approaches has distinct disadvantages and limitations. For example, self-tapping screws are limited in the maximum pull-out load that can be achieved on a thin facesheet, and final failure often involves debonding large areas of the facesheets. Through-bolting affects the backside profile of the panel and introduces a production cost associated with having workers on both sides of the bulkhead for installation. The desired solution should be scalable by weight of attached equipment and variations in sandwich panel design. Additionally the attachment method should be provided as a system to the shipyard. By 'system' it is implied that the shipyard be supplied with a total package including any tooling, adhesives, and hardware needed to apply the method.

PHASE I: Develop an attachment system and analytically demonstrate the range of application. Build prototype hardware and perform static validation testing.

PHASE II: Refine the design approach. Develop a test plan to qualify the system for shock loading over a range of weights and composite sandwich thicknesses. Develop required tools/tooling and demonstrate installation.

PHASE III: Develop a complete turn-key installation system and accompanying design manual for use in shipyards. Demonstrate application on a US Navy ship.

DUAL-USE POTENTIAL: Composite sandwich structures are prevalent in a wide range of commercial transportation industries including yachts, buses, trains and aircraft. Applications into the civil engineering sector (building and bridge applications), although not fully developed at present, are growing. Specific solutions on how to attach outfitting items to these structures are a recurring design issue.

REFERENCES:

1. Handbook of Sandwich Construction", Editor D.Zenkert, EMAS Publishing, 1997.
2. Marine Design Manual For Fiberglass Reinforced Plastics, Gibbs & Cox, Inc., sponsored by Owens-Corning Fiberglas Corporation, McGraw-Hill, New York, 1960
3. "Partial Inserts in Sandwich Panels - Fatigue Tests", J.Kepler, Sandwich Construction 4, Volume II, Karl-Axel Olsson Editor, Proceedings of the Fourth International Conference on Sandwich Construction, June 1998, EMAS Publishing.

KEYWORDS: Composites; Sandwich; Outfitting; Attachments; Ships; Fasteners

N01-T004 TITLE: Reconfiguration of Component Level Control Network Automation Systems

TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes

OBJECTIVE: To reduce the latency of network reconfiguration in a distributed control infrastructure for component level based automation systems on Naval Platforms.

DESCRIPTION: A key parameter governing the cost and performance of a system with reconfiguration capability, such as a communication system with the capability of healing a damaged network, is the latency of reconfiguration (time between failure detection and fix). Different systems have different tolerance thresholds for network communications latencies. The level of redundancy required to ensure small latencies could be cost prohibitive. Healing involves some combination of overloading existing resources and/or marshalling redundant resources. By predicting where damage is likely to occur, one could utilize redundant resources to reconfigure the network in anticipation of the damage event. The objective of this would be to steer traffic away from the predicted damaged network segment. By pre-positioning network resources prior to the damage event, the processing required to determine the appropriate healing path could be reduced to a simple reconfiguration step, thus reducing damage induced latency from the healing process.

The system is a component level or device level automation infrastructure for Navy Shipboard automation, using the ANSI 709.1 control protocol.

The system employs a dependable network topology consisting of a partial mesh of network rings. Each node in the network is attached to a wire ring and the rings are connected with routers. There are redundant routers on each ring. Under normal operation the redundant routers are off-line. In the event of damage, parts of each ring may become fragmented and therefore no longer able to talk to other parts of the ring or to neighboring rings. A concept called "network fragment healing" re-configures the routers to "heal" the network It reconnects the fragments by routing traffic through neighboring rings. This "healing" may include bringing some of the redundant routers on-line and changing the communication parameters of the nodes to reduce the traffic load. Criteria used for rerouting include load balancing and prioritization of traffic based on critical services. The logic for doing the reconfiguration is held by sentinal nodes. Reconfiguration takes time. Sentinals search the network to determine the extent of damage and paths to heal, and re-configure the routers and nodes by sending messages. While the reconfiguration is underway network traffic may be interrupted.

Simple approaches to reconfiguration treat all traffic and all nodes as equivalent. The logic for reconfiguration gets more complex as more details about the node functionality get used. At some point it becomes difficult to re-configure correctly without more comprehensive knowledge such as might be provided by a model. Moreover in the case of pre-hit configuration, it would be helpful to be able to "predict" the effects of the reconfiguration before attempting to re-configure. Thus a model of the system that determines pre-hit the likely extent of damage, will allow for reconfiguration with reduce latency.

Example: Suppose the radar systems predicts a missile will hit the ship and damage compartment A. In compartment A are several systems using the component level automation network, i.e. the chill water system and damage control sensors. Under

normal operating conditions the combined traffic of all the devices in compartment A uses 25% of the bandwidth. After the hit it is expected that the damage control sensors will use 75% of the bandwidth (the damage will generate a lot of alarms and damage indications). This will saturate the channel, and drive down the channel efficiency. Damage may fragment the network and cause nodes to be isolated. The chill water system will go into war fighting mode and shed all its non-critical loads.
A pre-hit reconfiguration system would, upon reception of the expected hit notification, search for likely healing paths and re-configure the routers before the hit occurs and while the network still has sufficient reserve capacity. In addition the system might reduce traffic by re-configuring the nodes on non critical sensors and actuators by updating monitoring traffic at a slower rate, or not at all for the time required to re-configure after the hit. The time it takes to recover from the damage might be reduced enough so that the capability of the damage control system is not so adversely affected.

PHASE I: Given a pre-hit configuration for a component level automation infrastructure, design a model to predict the system state resulting from various damage scenarios, and determine the optimal pre-hit configuration that would minimize disruption of the infrastructure for each such damage scenario.

PHASE II: Develop and integrate the model into a demonstration of network fragment healing infrastructure for pre-hit configuration.

PHASE III: Refine and enhance the model and pre-hit reconfiguration for integration into a full-scale network. Extend the model to include ship systems built on automation infrastructure.

DUAL-USE POTENTIAL: Mission critical or continuous available systems such as process control, security, or transportation are severely impacted by an interruption due to damage, vandalism, or catastrophe. Pre-damage reconfiguration can ameliorate or reduce the total impact on these systems.

KEYWORDS: Automation; Network Fragment Healing; Reconfiguration; Latency; Damage Tolerance; Message Traffic

N01-T005 TITLE: Oxygen Source for Underwater Vehicle Fuel Cells

TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes, Weapons

DOD ACQUISITION PROGRAM SUPPORTING THIS TOPIC: AN/BLQ-11 (Long Term Mine Reconnaissance System)

OBJECTIVE: Develop and demonstrate an oxygen storage and generation system capable of providing oxygen to a fuel cell power source for an underwater vehicle. The oxygen system must be safe, readily recharge or replenished, compatible with operation on surface ships and submarines, and capable of providing sufficient oxygen to operate a fuel cell over a broad power range.

DESCRIPTION: Underwater vehicles will serve as key elements in integrated operations of future surface ships and submarines, providing a range of support functions including autonomous surveillance, mine counter measures, and special forces transport. However, current power sources for these vehicles (rechargeable silver-zinc batteries or high-energy primary batteries) do not meet the energy requirements for future missions, or they impose a tremendous logistics burden on the host vessel. Fuel cells offer a viable option for meeting mission energy requirements, an at the same time, they can reduce the host vessel logistics burden if the fuel and oxidizer can be generated onboard or stored in a high energy density format.

Fuel cells operating on hydrogen or more complex fuels (such as high energy density hydrocarbons) and oxygen are attractive as underwater power sources because they are efficient, quiet, compact, and easy to maintain. The total energy delivered by a fuel cell system is limited only by the amount of fuel and oxygen available to the fuel cell energy conversion stack. Unlike ground and air transportation fuel cell systems that only require an onboard fuel, underwater vehicles must carry both the fuel and the oxygen source because the oxygen concentration in the ocean is insufficient to meet vehicle power requirements. The underwater vehicle oxygen source must possess a high oxygen content (both weight and volume based) to accommodate the weight and volume constraints of the vehicle design. On the other hand, traditional high-density oxygen sources, such as NaClO3 candles, are not readily recharged and can easily exceed 50% of the total weight of the fuel cell system.

Therefore, innovative oxygen storage and generation systems are sought to provide gaseous oxygen for fuel cells operating in self-contained underwater vehicles. The oxygen source must be readily and rapidly recharged or replenished using gaseous oxygen, chemical or electrochemical regeneration, mechanical replacement, or other innovative approaches. The proposed system must include all components to (i) store oxygen in a safe high-density format, (ii) deliver clean oxygen at nominal fuel cell cathode operating conditions (e.g., 1 – 3 atmospheres of pressure), and (iii) accomplish rapid recharging or replenishment on a host vessel. Oxygen generation should be capable of multiple stops/restarts and be controllable over a broad range of oxygen delivery rates. Delivery rates should be sufficient to power a typical fuel cell stack from 10 W to 10 kW (ca. 0.1 to 100 grams oxygen gas per minute). Oxygen storage capacity should be scalable to provide a minimum of 50 kilograms of useable oxygen gas. The available oxygen capacity should be maximized on a total system weight basis (i.e. weight percent oxygen), while maintaining a high volumetric density for the overall system.

PHASE I: Demonstrate a high-density oxygen storage and generation system in bench-scale experiments. Demonstrate the capability to recharge or replenish the oxygen source. Provide detailed design of an integrated oxygen system.

PHASE II: Construct and evaluate the oxygen system at the brassboard level of integration. Demonstrate controlled oxygen generation rates from 0.1 to 100 grams per hour, start/stop/restart capabilities, and recharge or replenishment capabilities. Make system available for attachment to a fuel cell for Naval laboratory testing.

PHASE III: Design and construct a fully integrated oxygen system for operation in Navy-designated undersea vehicle powered with a fuel cell.

DUAL-USE POTENTIAL: High-density oxygen storage and generation systems will make it possible to power commercial underwater vehicles with fuel cells. Rechargeable oxygen systems can be used to provide breathable oxygen for scuba diving, medical applications, emergency respirators, and aviation air supplies. Portable oxygen generators can be used to replace high-pressure oxygen cylinders for many industrial applications requiring on-site oxygen or enriched air processing.

REFERENCES:

1. Fuel Cell Systems, Leo J. M. J. Blomen, Michael N. Mugrewa, Ed., Plenum Publication Corp., NY (1994).
2. Undersea Vehicles and National Needs, National Research Council, National Academy Press, Washington D.C. (1996).
3. An Assessment of Undersea Weapons Science and Technology, National Research Council, National Academy Press, Washington D.C. (2000).
4. Russel R. Bessette, et al., J. Power Sources, 80 (1999) 248-253.
5. Øistein Hasvold, et al., J. Power Sources, 80 (1999) 254-260.

KEYWORDS: Oxygen; Fuel Cell; Underwater; Power; Energy; Respirators

N01-T006 TITLE: Reduced Flammability Vinyl Ester Resin Containing no Halogens for Use in Large Composite Ship Surface Structures via Nanocomposite Technology

TECHNOLOGY AREAS: Materials/Processes

DOD ACQUISITION PROGRAM SUPPORTING THIS TOPIC: DD21 (PMS 500) and Virginia class submarine (PMS 450)

OBJECTIVE: Develop a low flammability vinyl ester resin that contains no halogens and has similar processibility (viscosity, cure properties) and mechanical properties to the Navy standard vinyl ester Derakane 510A. Lower flammability includes less smoke and carbon monoxide generation and a reduced heat release rate. The suggested route for obtaining low flammability is the broadly defined 'nanocomposite' approach in which a small amount of an inflammable material (possibly inorganic) is dispersed on a nano-scale.

DESCRIPTION: The Navy is concerned with reducing the flammability of fiberglass structures through use of nonhalogenated resins. Fiberglass is used to make large structures because of processibility and low cost. Any approach taken to reduce flammability therefore must not significantly increase cost or alter processibility. The 'nanocomposite' approach shows promise. For example, the incorporation of treated clays which exfoliate into isolated sheets 2 nanometers thick and microns in length and width has been shown to greatly reduce flammability in several resin systems (ref. 1,2) It is believed that the inorganic silicate structure supports the polymer resin structure during a fire preventing flow, and as surface resin is burned away, the inflammable silicate layers form a surface layer which impedes the flow of oxygen to the remaining organic resin. Such an approach has the potential of being cheap (clay) and only slightly altering processing (use of 2-5 weight percent may be sufficient). The term 'nanocomposite' is broadly defined in this solicitation, and pertains to many morphologies beyond exfoliated clays.

The Navy standard low flammability vinyl ester resin is Derakane 510A. The goal is reduced flammability and similar or improved processing and mechanical properties from a nonhalogenated resin and at a reasonable cost.

PHASE I: Development of the resin, small scale characterization of viscosity and cure, small scale testing for flammability (such as ASTM E1354 Cone Calorimetry for heat release rate, mass loss, carbon monoxide, and smoke production), and neat mechanical properties.

PHASE II: Scale up of the resin, production of fiberglass panels, mechanical characterization, and full scale demonstration, i.e., mechanical and fire testing (such as ISO 9705 Room Corner Fire Test).

PHASE III: Commercialization through an interested third party.

DUAL-USE POTENTIAL: Fiberglass is used in the home (vanities, countertops, ladders), in vehicles, in boats, airplane interior compartments, and many other places where reduced flammability is an issue.

REFERENCES:

1. E.P. Giannelis, Advanced Materials, 8, 29, (1996).

2. J.W. Gilman, T. Kashiwagi, J.D. Lichtenhan, "Nanocomposites: A Revolutionary New Flame Retardant Approach", SAMPE Journal, 33(4), July/August 1997.

KEYWORDS: Nanocomposite; Vinyl Ester Resin; Fiberglass; Nonhalogenated Resin; Flame Retardant; Exfoliated Clays

N01-T007 TITLE: Low Cost Composite Manufacturing of Large Scale Hydrodynamic Surfaces

TECHNOLOGY AREAS: Materials/Processes

DOD ACQUISITION PROGRAM SUPPORTING THIS TOPIC: FNC: Total Ownership Cost Reduction

OBJECTIVE Develop low cost vacuum assisted resin transfer molding (VARTM)composite fabrication technique and design for the manufacturing of dimensionally critical hydrodynamically smooth lifting surfaces for Naval vessels.

DESCRIPTION: Large scale composite Naval applications are currently manufactured using VARTM techniques. VARTM processing typically uses one mold surface and a bag surface. For dimensionally critical structures requiring two hydrodynamic smooth surfaces, conventional VARTM is not applicable. The technique that is typically used is resin transfer molding (RTM) which uses a closed mold. Manufacturing techniques such as RTM are generally too expensive to use for large scale applications. The reason for this is that the mold that is required for RTM is typically very costly. In addition, there has been minimal experience base for manufacturing of large scale RTM parts which have surface which are 150 square feet or more. This program is looking to develop a VARTM type low cost process which can be used to manufacture structures which require high tolerances on dimensions and will have all surfaces which are smooth. In addition, optimum lifting surfaces would have angles of attack which are maintained over a large pressure loading. This requires that the lifting surfaces react to structural loading so that it experiences minimal deformation. This can be accomplished using composite materials by properly designing the laminate stacking sequence to achieve the appropriate stress couplings.

PHASE I: Conceptualize and demonstrate the ability to use a low cost VARTM process that can be used to manufacture a structure with two hydrodynamically smooth surfaces having complex curvature. In addition, provide a conceptual design that will allow a lifting surface shape to maintain an optimum angle of attack over a large pressure range. This should be demonstrated through both the manufacturing of small scale sections using the proposed VARTM technique and loading the manufactured structure to verify that the structure will have the appropriate reacting load to maintain its shape.

PHASE II: Manufacture a large scale composite lifting surface with two hydrodynamically smooth faces using the developed low cost VARTM process. Demonstrate that the structure has been designed to maintain an optimum angle of attack over a large pressure range through hydrodynamic testing of a full scale component.

PHASE III: Manufacture and qualify a full scale composite lifting surface optimized for low cost and with demonstrated property of being able to maintain optimum angle of attack. This structure will be installed on a surface ship such as a DDG-51 flight 2-A class ship for ship evaluation.

DUAL-USE POTENTIAL: The technology could be utilized to manufacture similar lifting surfaces for large ocean going vessels such as cargo and cruise ships as well as Coast Guard vessels.

REFERENCES:

1. Gowing, Scott, Coffin, Paul, and Dai, Charles, "Hydrofoil Cavitation Improvements with Elastically Coupled Composite Materials", Proceedings of the 25th American Towing Tank Conference, Iowa City Iowa, Sept. 1998.

KEYWORDS: VARTM; Composites; Hydrodynamic Surfaces; Bending-Twisting Coupling Design

N01-T008 TITLE: Microbubble Drag Reduction Demonstration

TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes

DOD ACQUISITION PROGRAM SUPPORTING THIS TOPIC: FNC: Expeditionary Logistics

OBJECTIVE: An intermediate to large scale sea-borne implementation of microbubble drag reduction (MBDR) is desired to determine scale-up and seawater effects on the efficacy of the technique, as well as on bubble and ejection parameters, and robustness in at-sea conditions.

DESCRIPTION: The injection of microbubbles into a turbulent boundary layer has been demonstrated to reduce frictional drag up to 80% in laboratory scale tests. Though the speeds of the tests have been as high as 50 knots, the models were small, and the

tests were conducted in fresh water. As scale is increased to that of sea-going vessels, the usefulness of the technique is unknown. It is desirable to perform tests of MBDR on larger sea-going platforms at speeds sufficiently high to approach or exceed a Reynolds number of 2x10^8. A length of at least 10 meters is desired. Hydrofoil and SWATH configurations would be particularly attractive since friction is the predominant drag contribution in those cases. Measurements of flow and microbubble variables at these larger scales are needed to establish a knowledge-base sufficient for design.

PHASE I: A laboratory demonstration of a microbubble injection technique based on present knowledge and scaled up for a sea-borne platform implementation will be required. A platform will need to be identified, and a detailed design of the at-sea test system will need to be completed, including alterations to the platform. Instrumentation will need to be designed or selected to measure the expected drag reduction and MBDR parameters with adequate resolution and accuracy as exhibited in an uncertainty analysis.

PHASE II: At-sea trials on the selected platform will be conducted to determine the performance of the MBDR system. Bubble injection parameters and platform operation, such as speed, turns, seastate, etc., will be varied to develop a database of performance. Measurements of drag reduction and other variables, such as air flowrate, plenum pressure, and bubble distribution, will be performed. A total system energy balance, including air pumping will be performed.

PHASE III: Both the Navy and the commercial sector are expected to be highly interested in this technique if found to be feasible at ship scale because of increasing interest in the reduction of fuel consumption. Existing and near future hydrofoil, SWATH, and similar configurations would be expected to be the initial target of application since frictional drag is relatively more important for these configurations. Future larger sealift ships of similar design are also envisioned.

DUAL-USE POTENTIAL: The growing market for high-speed ferries would be the prime initial commercial target for MBDR application. Many of these utilize configurations which could benefit from a successful application of drag reduction. Larger ships would benefit eventually if the technology proves to be useful and adaptable to more conventional hull-forms.

REFERENCES:

1. Madavan, M.K., Deutsch, S. and Merkle, C.L, "Measurements of local skin friction in a microbubble-modified turbulent boundary layer," J. Fluid Mech. V.156, 1985.
2. Deutsch, S., and Castano, J., "Microbubble skin friction reduction on an axisymmetric body", PSU/ARL-TM-85-139 , available in DTIC as ADA247709, WWW.DTIC.mil.
3. Marie, J.L., "A simple analytical formulation for microbubble drag reduction", Physicochemical Hydrodynamics V.8 no.2, 1987.

KEYWORDS: Microbubble; Drag Reduction; Ship; Hydrofoil; SWATH; Demonstration

N01-T009 TITLE: Permanent magnets with improved mechanical properties for propulsion

TECHNOLOGY AREAS: Materials/Processes

OBJECTIVE: To develop rare earth-based, high energy product permanent magnets with improved toughness for motors for ship and underwater vehicle propulsion. Advances in bonding of magnets to structural components, improved adhesion of protective coatings, and improved mechanical stability, all of which depend on improved toughness of the magnets, are desired in order to improve the performance and reduce the cost and weight of permanent magnet motors. These properties are also desired for magnetic levitation applications such as electromagnetic launch and recovery systems for aircraft.

DESCRIPTION: Permanent magnet motors offer several advantages for ship propulsion. Eliminating brushes improves reliability and reduces maintenance. Concepts such as the integrated motor-propulsor, where a permanent magnet rotor serves as the propeller, offer reduced size and weight in addition. High performance rare-earth-based permanent magnets can provide very high energy densities, i.e. both large effective fields and good resistance to demagnetization. However the hard magnetic phase in these magnets is an intermetallic compound which is brittle and susceptible to oxidation. Recent proposals to combine the hard magnet phase with a high magnetization iron-based phase to increase the energy product, might also lead to improved toughness. These magnets need to be coated to protect them from the corrosive salt-water environment, and they must be bonded to the rotor (or stator) structure material. Improved toughness is needed to insure the integrity of these bonds. If the magnets could be shaped into desired motor structures, and if their mechanical properties were sufficient for them to provide part of the strength of the structure, it would be possible to reduce the purely mechanical components of the motor.

PHASE I: Identify materials and/or processing schemes and demonstrate that they provide improved toughness of currently available permanent magnets, with equal of improved energy product.

PHASE II: Optimize composition and microstructure to maximize toughness. Demonstrate improvements in bonding to structural materials, adhesion of coatings, or mechanical stability of shaped propulsor blades in realistic test environment.

PHASE III: The improved magnet material will be incorporated into a permanent magnet motor or an integrated motor-propulsor demonstration.

DUAL-USE POTENTIAL: Permanent magnet motors are used in commercial appliances, and in automotive applications.

REFERENCES:
1. Technological properties of permanent magnets are discussed in the yearly proceedings of the Intermag Conference, which are published in the IEEE Transactions on Magnetics.

KEYWORDS: Permanent Magnets; Rare Earth Magnets; Toughness; Mechanical Stability; Coatings; Permanent Magnet Motors

N01-T010 TITLE: Advanced Fluid Modeling Capability for Underwater Shock Analysis of Naval Platforms

TECHNOLOGY AREAS: Materials/Processes

DOD ACQUISITION PROGRAM SUPPORTING THIS TOPIC: FNC: Platform Protection; MCM

OBJECTIVE: Develop and implement advanced fluid modeling capability for use in underwater shock analyses to support design optimization of ship and submarine hull structures

DESCRIPTION: Ship and submarine platforms must be designed to withstand nearby detonations of underwater weapons such as mines and torpedoes. The detonation of an underwater weapon produces a complex loading from the shock wave and gas bubble from the detonation products, which interacts with the surrounding water, the sea bottom, the water surface, and any other nearby surfaces. Accurate prediction of the development and propagation of the loading to the platform is essential for assessing the response of the platform. More accurate load prediction for complex, real world environments will facilitate the optimization of structural hull designs and hull protection systems, resulting in lighter and more survivable hull configurations.

PHASE I: Demonstrate the applicability of advanced fluid modeling techniques such as level set methods to solve underwater shock benchmark problems.

PHASE II: Implement the advanced fluids solver into software packages currently in use for ship and submarine shock analysis. Validate against relevant test data. Apply new capability to optimize passive ship hull protection systems.

PHASE III: Transition new capability to Navy simulation development programs and ship/submarine hull design programs. Apply the new capability to support the design of passive hull protection systems, resulting in more affordable, lighter, and more survivable hull designs.

DUAL-USE POTENTIAL: Advanced fluid solvers will be implemented in design tools for a variety of commercial applications. These include (i) oil rig demolition, (ii) mitigation of explosion effects on structures and marine life during harbor construction and demolition, (iii) understanding fluid flow issues in hydraulic machinery and reactor systems, (iv) addressing seakeeping and maneuverability issues (waveloading effects) for large commercial vessels, and (v) design of commercial double hulled tankers.

REFERENCES:
1. Hansen, Ib, They Must Be Sturdy, Proceedings of the U.S. Naval Institute, pp. 50-54, October 2000.

KEYWORDS: Underwater Explosions; UNDEX; Euler Modeling; Free Surfaces; Fluid Modeling; Shock Analysis

AIR FORCE
PROPOSAL PREPARATION INSTRUCTIONS

The responsibility for the implementation and management of the Air Force STTR Program is with the Air Force Research Lab, Wright-Patterson Air Force Base, Ohio. The Air Force STTR Program Manager is Steve Guilfoos, (800)222-0336.. All Phase I and Phase II STTR proposals **MUST** be submitted to the following administrative organization.

Air Force Office of Scientific Research AFOSR/NI
4040 N. Fairfax Dr., Ste 500
Arlington VA 2203-1613
Attn: Dr. Victoria Franques
Phone: (703) 696-7313, Fax: (703) 696-7320
Email-victoria.franques@afosr.af.mil

The Pre-Solicitation Announcement (PSA), listing the full descriptions of the topics and the author of each, is issued electronically after being announced in the Commerce Business Daily. Contact AFOSR directly for information on future PSAs. Open discussions concerning technical questions pertaining to the topics can be held with topic authors (as listed in the PSA) until the solicitation formally opens. Once the solicitation opens the only way to ask pertinent technical questions about a topic with the topic author is through the DTIC SBIR Interactive Technical Information System (SITIS). For a full description of this system and the other technical information assistance available from DTIC, please refer to Section 1.5c of this solicitation.

Unless otherwise stated in the topic, Phase I will show the concept feasibility and Phase II will produce a prototype or at least show a proof-of-principle.

Phase I period of performance is typically 1 year not to exceed $100,000.

Phase II period of performance is typically 2 years not to exceed $500,000. The solicitation closing dates and times are firm.

Air Force Fast Track

Detailed instructions on the Air Force Fast Track and Phase II proposals will be given out by the awarding Air Force directorate along with the Phase I contracts. The Air Force encourages businesses to consider Fast Track application when they can attract outside funding and the technology is mature enough to be ready for application following successful completion of the Phase II contract. Further information on the STTR Fast Track can be found in Section 4.5 of this solicitation.

Commercial Potential Evidence

An offeror needs to document their Phase I or II proposal's commercial potential as follows: 1) the small business concern's record of commercializing STTR or other research, particularly as reflected in its Company Commercialization Report (www.DoD.sbir.net/companycommercialization; 2) the existence of second phase funding commitments from private sector or non-SBIR funding sources; 3) the existence of third phase follow-on commitments for the subject of the research and 4) the presence of other indicators of commercial potential of the idea, including the small business' commercialization strategy.

Submission of Final Reports

All final reports will be submitted to the sponsoring agency. Companies **will not** submit final reports directly to DTIC.

Proposal Submission Instructions

Your proposal will be ACCEPTED if you meet all of the following criteria. Failure to meet any one of the criteria will result in your proposal being REJECTED.

1. You must use the electronic format described in the Electronic Submission described below. The Air Force will not accept any proposals that do not have electronic forms of the Proposal Cover Sheet (formerly," Appendix A and B "). The electronic forms submitted must match the paper copies submitted via mail/express delivery.

2. A copy of the Company Commercialization Report (formerly Appendix E) with summary page must be submitted with all proposals (See Section 3.4n of the solicitation). Even if you have no Phase I or Phase II information to report, you must submit a Company Commercialization Report. Your proposal will not be penalized in the evaluation process if your company never had any STTR Phase I's or II's in the past. Both the electronic submission of the Proposal Cover Sheet and the paper copies of your proposal must be received on or before the solicitation deadline unless it was sent by U.S. Postal Service Express Mail Next Day Service-Post Office to Addressee, not later than 5:00 p.m. at the place of mailing two working days prior to the date specified for receipt of proposals. The term "working days" excludes weekends and U.S. Federal holidays. The Air Force will not accept late proposals, or incomplete proposals. If you have any questions or problems with submission of your proposal allow yourself enough time to contact the Air Force and get an answer to your question. Submit the Electronic Proposal Cover Sheet and Company Commercialization Report early, as computer traffic increases, computer speed slows down. **Do not wait until the last minute**. The Air Force will not be responsible for late proposals caused by computer systems or servers being " down " or inaccessible. The Air Force will not be held responsible for late delivery of proposals, be advised that an Overnight delivery may not reach the appropriate desk within one day.

Electronic Submission of Proposal Cover Sheet and Commercialization Report

Submit your Proposal Cover Sheet (formerly Appendix A and B) and the Company Commercialization Report (formerly Appendix E) to the Air Force using the DoD online submission at http://www.dodsbir.net/submission and as discussed in section 3.4b and 3.4n of this solicitation. This site allows your company to come in any time (prior to the closing of the solicitation) to edit or print out your appendices. The Air Force will not accept any forms from past solicitation books or any electronic download version except those from the DoD SBIR Website as valid proposal submission forms. Detailed instructions can be found by selecting the Help button on this site once you have registered. If you have any questions or problems with the electronic submission contact the DoD SBIR Helpdesk at 1-800-382-4634.
Once you have prepared, printed, and signed the Proposal Cover Sheet, mail it along with one original and three copies of your entire proposal (the copies should include three copies of the signed Proposal Cover Sheets) to the Air Force Office of Scientific Research (AFOSR).

PROPOSAL SUBMISSION INSTRUCTIONS

TOPIC NUMBER	ACTIVITY/MAILING ADDRESS (Name and number for mailing proposals and for administrative questions)	CONTRACTING AUTHORITY (For contract questions only)
AF01T002 thru AF01T015 AF01T018	Air Force Office of Scientific Research AFOSR/NI 4040 N. Fairfax Dr., Ste 500 Arlington VA 22203-1613 (Victoria Franques, (703) 696-7313)	Richard Pihl (703)696-9728

FY01 AIR FORCE STTR TOPICS

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH, ARLINGTON VA

AF01T002	Terahertz Quantum Well Emitters and Detectors
AF01T003	Crested Quantum Tunneling Barriers for Advanced Data Storage Systems
AF01T004	Micromachined Deformable Mirrors for Beam Control and Imaging Applications
AF01T005	Reactants and Combustion Processes for Neutralization of Chemical and Biological Agents
AF01T006	High Stiffness Passive Damping Concepts Using Materials or Innovative Mechanisms
AF01T007	Development of Advanced Crystalline Garnet Materials and Fibers
AF01T008	High Temperature, High Bandwidth, Pressure Transducer
AF01T009	High Frequency Electromagnetic Propagation / Scattering Codes
AF01T010	Machine Learning for Record Linkage
AF01T011	Closed-Loop Flow Control for External Aerodynamics
AF01T012	Advanced Hearing Protection
AF01T013	Polymer Based Photovoltaic for Space Applications
AF01T014	Biomimetic Inspired Fibers, Materials, and Properties
AF01T015	Affordable Airframe Life Extension: Designer Corrosion Suppression Technologies
AF01T018	Develop Turnable Adhesive Coatings (Release on Command) for Corrosion Prevention in Aging Aircraft

AF01T002 TITLE: Terahertz Quantum Well Emitters and Detectors

TECHNOLOGY AREAS: Sensors, Electronics, and Battlespace Environment

OBJECTIVE: Development of solid state terahertz quantum device structures for operation in the range between 0.3 Thz to 10 Thz that are suitable for coherent sources and detectors for use in space-based and short range terrestial communications, atmospheric sensing, and near object analysis.

DESCRIPTION: The terahertz frequency range (0.3 – 10 THz) is one of the last frontiers in the electromagnetic spectrum. The lower microwave and millimeter wave frequency regions have been and continue to be exploited for numerous wireless communication and radar applications, whereas the optical and infrared frequencies are being used for high bandwidth data transmission and some niche applications, including night vision. However, terahertz applications have been slow to develop, mainly due to the lack of miniature, reliable sources, detectors and related passive components. The region offers the potential for a number of applications including space-based and short-range terrestrial or near earth communications, atmospheric sensing, collision avoidance for aircraft and ground vehicles, and near object observation and spectroscopy. To realize this potential the appropriate sources and detectors need to be developed.Innovative approaches are needed leading to the development, fabrication, and operation of coherent quantum well terahertz sources. Desired are approaches in quantum wells and tunneling devices, as well as other novel quantum structure approaches. The goals of this effort are devices and device concepts that will deliver coherent radiation at potentially milliwatt power level, ultimately coupled efficiently in THz circuits, guided wave structures and antennas. Work is needed in detectors to greatly improve the sensitivity, speed, and bandwidth. Specifically desired are efforts in semiconductor-based quantum well structures and the subsequent development of a useable detector that is narrow band, widely tunable, and yet highly sensitive. Approaches toward compact system modules addressing both generation and detection are also of interest.

PHASE I: Clearly demonstrate the feasibility of the proposed approach. Define the quantum well device that will deliver up to milliwatts of coherent radiation at specified frequencies in the THz regime, and/or define the quantum well detector or detector structure detailing optimal geometry, bandwidth limitations, tunability, and current-carrying capacity. The definition of the device/ system-module needs to include principal of operation, material, processing, associated circuit or guided wave structure, and regime of operation.

PHASE II: Build upon Phase 1 work and demonstration of system components and implementation of a prototype. Perform appropriate analysis and modeling, grow the material or structure, fabricate the device and test its performance.

PHASE III DUAL USE APPLICATIONS: Terahertz photonics have selected potential applications. Covert communication on the battlefield or in space, chemical agent detection, atmospheric environment sensing, near object detection, material imaging will benefit from new technology in this part of the electromagnetic spectrum.

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2. "Inverse Bloch Oscillator: Strong Terahertz-Photocurrent Resonances at the Bloch Frequency"; K. Unterrainer, B.J. Keay, M.C. Wanke, S.J. Allen, D. Leonard, G. Medeiros-Ribeiro, U. Bhattacharya, and M.J.W. Rodwell; Physical Review Letters, Vol. 76, 2973-6 (1996).

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KEYWORDS: Terahertz devices, terahertz emitters, terahertz detectors, terahertz sources, submilimeter, spaced-based communications, atmosheric sensing, quantum well, quantum device imaging

AF01T003 TITLE: Crested Quantum Tunneling Barriers for Advanced Data Storage Systems

TECHNOLOGY AREAS: Information Systems Technology

OBJECTIVE: Establish the basis for advanced digital memory and data storage systems with density beyond 1 terabit/cm2 and sub-10-ns read/write/erase time.

DESCRIPTION: Ultradense storage of large blocks of digital data, with the possibility of their fast, byte-addressable retrieval is a pivotal issue as the Air Force defines its future C4I war-fighting role. Battlefield management, especially if supplemented by simulation, also will require enormous data storage that is accessible by computers in real time, ideally in a few nanoseconds. Currently, hardware for ultra-dense, fast memory storage does not exist. Moreover, the rapid progress toward such systems by the electronics industry is slowing. In particular, dynamic random access memories are inherently non-scalable, and their density will very likely saturate at the level of several Gb/cm2 [1]. On the other hand, non-volatile, floating-gate memories are scalable, but their application in most systems is limited by long write/erase times, typically above 1 microsecond [2]. Finally, mainstream magnetic data storage systems are rapidly approaching an apparent fundamental density limit, somewhere in the low 100s of Mb/cm2. Proposed "crested" multilayer tunnel barriers [3] provide a remarkable opportunity to overcome the density-to-speed trade-offs of current data storage technologies. These barriers may permit the combination of an acceptable electric-charge retention time (beyond 10 years) with a sub-10-ns recharging time, and thus enable scalable and fast non-volatile memories (NOVORAM) [4] and electrostatic data storage systems (ESTOR) [3] with potential density well beyond 1 Tb/cm2. In the future, crested barriers also may make ultra-dense, terabit-scale single-electron memories possible [5]. However, implementation of crested barriers requires fabrication of high-quality multi-layers of wide-bandgap semiconductors (e.g., AlxGa1-xN) which have not yet been demonstrated, since it requires advanced film deposition techniques (e.g., MOCVD, etc.).

PHASE I: Develop the technology for deposition of 10-nm-scale crested tunnel barriers based on wide-bandgap semiconductors or other suitable materials. Demonstrate the effect of acceleration on Fowler-Nordheim tunneling due to barrier shaping.

PHASE II: Fabricate and test prototype semiconductor memory cells using crested barriers, with write/erase time below 10 ns. Explore retention time of these cells and their endurance under electric stress, and prove their scalability. Demonstrate a prototype electrostatic data storage system and explore its speed performance.

PHASE III DUAL USE APPLICATIONS: The development of fast, ultra-dense semiconductor memories and data storage systems for the most challenging DoD missions, will provide a basis for their commercial introduction into the rapidly growing digital data storage market, including personal computers, corporate and internet servers.

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KEYWORDS: Micromachining, Deformable mirror, Adaptive optics, Abberation, Laser wavefront control.

AF01T004 TITLE: Micromachined Deformable Mirrors for Beam Control and Imaging Applications

TECHNOLOGY AREAS: Materials / Processes

OBJECTIVE: Develop scaleable, low-cost, deformable mirrors, for application to laser wavefront control and active aberration compensation for imaging and communication through the atmosphere, and for other dynamic aberrating media.

DESCRIPTION: Adaptive optical systems are a potential avenue for enhancing Air Force and DOD imaging, communications, and laser systems performance. Examples include space-to-ground and ground-to-ground

communications, enhanced battlefield imaging, laser-based missile defense systems, laser illumination of a target through the atmosphere, smart-missile target identification, enhanced laser amplifier energy extraction, enhanced non-linear optics conversion via laser intensity profile control, and remote imaging and sensing. At the present time, there are no commercial deformable mirrors with sufficient engineering control, low-cost, and adequate response times to address the needs of the military community. The requirements for deformable mirrors, including disposability in some applications, make micromachining an attractive option for fabrication. Useful deformable mirrors must have good surface quality, to avoid loss of the incident radiation due to scatter and misdirection. Their architecture should address wire-packing problems currently facing the scaling of surface micromachined architectures. Deformable mirror surfaces should be capable of accepting dielectric coatings to enhance their reflectivity and increase their laser damage threshold. Novel actuator concepts are sought, to achieve useful actuator densities and cycling lifetimes.

PHASE I: Study micromachined mirror concepts, and demonstrate feasibility for low cost, high quality deformable mirrors. Design and show feasibility of suitable wavefront test procedures for the deformable mirrors to be studied.

PHASE II: Design and demonstrate micromachined deformable mirrors using the concepts studied in phase I. Fabricate and study scientific and engineering prototypes to understand their behavior and characteristics, and to elucidate potential processes to produce, assemble and test them. Develop optical diagnostic instrumentation capable of characterizing deformable mirrors after assembly, using the concepts demonstrated in Phase I.

PHASE III DUAL USE APPLICATIONS: The deformable mirrors developed under this topic will have value to commercial manufacturers of lasers and nonlinear optical systems used in displays, projection equipment, astronomical adaptive telescopes, photolithographic systems, surveillance and laser machining equipment. Small systems meeting the topic requirements would have many commercial and military customers.

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KEYWORDS: Micromachining, Deformable mirror, Adaptive optics, Abberation, Laser wavefront control.

AF01T005 TITLE: Reactants and Combustion Processes for Neutralization of Chemical and Biological Agents

TECHNOLOGY AREAS: Chemical/Biological Defense

OBJECTIVE: Synthesize and formulate improved chemical systems that produce vigorous reactants and sustain high temperatures in order to neutralize toxic chemical and biological agents. The improved chemical systems must consume these agents rapidly by combustion and fast reaction without dispersing them by causing an explosion.

DESCRIPTION: The neutralization and destruction of chemical- and biological agents introduce unique research challenges. In most cases, such agents cannot be destroyed by conventional explosives because the hazards of dispersing materials that are not fully neutralized. The need exists for new energetic materials and formulations that behave more like propellants than explosives. Such materials would react to produce large amounts of highly reactive, primary combustion products that would mix and react with the toxic agents. Combustion and sustained heating then would be the primary modes of destruction and neutralization. Literature is available on industrial incineration of the same agents and their simulates. The primary difference is that the industrial type incineration is accomplished under controlled conditions, whereas this topic seeks approaches for the neutralization in hostile, uncontrolled environments. The hazardous and diverse nature of the reactants makes the destruction difficult to characterize experimentally. Thus, laboratory experiments that simulate the ignition, flame spreading, mixing, etc processes are essential. For research purposes, it will be necessary to avoid experiments that introduce extraordinary hazards. Bacterial spores are among the most resistant forms of life. Hazardous chemical agents are often organic compounds containing organic heteroatoms. Therefore, research on the production type incineration of such agents provides the precedent for using chemical agent simulates (such as triethyl phosphate C6H15O4P) and nonhazardous materials with thermal decomposition properties similar to spores. To achieve these goals more efficiently, specialized energetic materials are needed that introduce

reactive combustion products. For example, ingredient ammonium perchlorate (AP), NH4ClO4, when burned with binders, produces high flame temperatures (>2500 K) and reactive products such as HCl, OH, etc. These reactive products further react with the surrounding atmosphere, disturbed environment, and targeted agents. Fluorine and its intermediate compounds are known to be more reactive than chlorine produced by conventional propellants. Systems that can produce large fractions of free fluorine are of particular interest. It is anticipated that the synthesis of the fluorinated compounds will require novel techniques that extend beyond the conventional NF2 chemistry.

PHASE I: A successful phase I effort will develop and assess a destruction concept based on either new energetic materials or nonconventional formations. The process controlling reaction steps and implementation schemes will be predicted. The initial questions concerning material synthesis or practicality and safety will be addressed. An experimental program of quantifying the effectiveness using simulants will be described.

PHASE II: A successful phase II effort will produce laboratory quantities of either a new material or nonconventional formulation that delivers reactive combustion products markedly superior to conventional propellant and reactant systems. Subscale experiments will be set up that quantify the ignition, mixing and flame spreading processes. The kinetics of the process controlling steps will be established. Appropriate flame models will be developed and used to correlate and explain the experimental findings. Analyses will develop the concept into a working prototype that can demonstrate the performance and effectiveness of the concept. Depending on the materials and concept, the use of DoD or industrial special test facilities can be proposed for measuring ignition and flame spread in a well instrumented, controlled, and safe environment. DoD facilities will be available at no cost to the contractor

PHASE III DUAL USE APPLICATIONS: The production potentials of the specialty materials and nonconventional formulations are large. The end-item will involve specialty packaging and custom delivery systems (i.e, airplane, missile, etc). Phase III funding probably requires involving an aerospace systems prime contractor to assess the market and to advise on the broader systems considerations. Stimulating the interest of an aerospace prime in the total system should be an integral part of the Phase II process. COMMERCIAL POTENTIAL: The demonstration of effective new energetic compounds and formulations could lead to production opportunities for military application. The underlying problem is not likely to go away. Dual use will involve the production of pyrotechnic devices and/or recipes for hazardous site protection and remediation in response to a toxic chemical or biological event.

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KEYWORDS: Combustion, Toxic agent neutralization, chem/bio defense, remediation.

AF01T006 TITLE: High Stiffness Passive Damping Concepts Using Materials or Innovative Mechanisms

TECHNOLOGY AREAS: Materials / Processes

OBJECTIVE: Model, develop and demonstrate novel concepts for passive damping in high stiffness structures by utilizing the unique properties of smart materials or innovative mechanisms.

DESCRIPTION: A large amount of passive damping is often desirable in order to minimize vibration in various types of structures. Furthermore, it is often advantageous to distribute damping mechanisms throughout the structure rather than at joints or attachment points, especially when it is desired that the structure as a whole remain stiff. In conventional practice, viscoelastic passive damping layers may be affixed to a structural member such that they absorb energy as they are deformed. Such treatments, however, are highly dependent on temperature, and provide only minimal damping for very stiff structures. Damping concepts are desired that can provide large damping, on the order of 20%, while maintaining structural stiffness. Such concepts may make use of magnetostrictive materials, shape memory alloys

(SMA) as a constraining layer, SMA ferromagnetic materials, particle damping, or other innovative active materials or mechanisms.

PHASE I: The scope of the Phase I effort will be to identify material systems and/or passive mechanisms with qualities that may be exploited for damping, while maintaining structural stiffness. Insensitivity or adaptability to temperature extremes is also desirable. Modeling and material characterization should be completed in this phase. Feasibility should be demonstrated.

PHASE II: The scope of the Phase II effort would be to construct a proof of concept demonstration of the technology developed in Phase I and characterize its performance over a range of temperatures and operating conditions. The results should be extrapolated to hypothesized performance in various applications.

PHASE III DUAL USE APPLICATIONS: Large precision deployable space structures will require large intrinsic damping while on orbit over an extreme temperature range. The structural members must also remain stiff to provide precision deployment and alignment.

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KEYWORDS: Damping, Smart materials, High stiffness structure

AF01T007 TITLE: Development of Advanced Crystalline Garnet Materials and Fibers

TECHNOLOGY AREAS: Materials / Processes

OBJECTIVE: Develop fundamental understanding and processing procedures for economical manufacturing of strong, creep resistant crystalline yttria-alumina garnet oxide fibers for use in high temperature structural components in oxidizing conditions.

DESCRIPTION: The cubic rare earth oxide - aluminum oxide garnets are promising candidates for use in high temperature structural applications requiring strength and creep resistance in oxidizing conditions. These materials are the best candidates for use in novel Air Force engine designs that require refractory ceramic fibers. The proposed research will provide the basis for synthesis of polycrystalline and single crystal rare earth aluminate fibers formed by heat treatment of precursors. The research will establish the use dopants and additives to: (i) control grain growth kinetics, (ii) stabilize microstructure at high temperatures, and (iii) obtain single crystal fibers by thermal treatment of polycrystalline materials. The Phase I research will focus on the yttrium aluminum oxide family of materials with addition/substitution of cations with different ionic radii and coordination number, oxidation number, and reaction phase stability to control grain boundary mobility.

PHASE I: 1. Demonstration of the synthesis of polycrystalline fibers from yttrium oxide-aluminum oxide fiber materials containing substituted cations.2. Controlled thermal processing of fibers at temperatures from 0.75 to 0.95 times the melting point (1450-1900C) for periods up to 6 hours to achieve grain growth and microstructural evolution.3. Transmission electron microscopy and microchemical analysis of materials.4. Correlation of process-structure relationships to develop a roadmap for synthesis of high temperature structural oxide materials to be implemented in Phase II.

PHASE II: Produce and demonstrate a prototype of advanced materials and provide samples to the Air Force for evaluation.

PHASE III DUAL USE APPLICATIONS: Lightweight composites require advanced oxide fibers for structural applications in military applications such as airframe structures and advanced engine components. Civilian applications include use in composites for components of turbines used in power generation and engine components used in

transportation, optical materials for transmission at infra-red wavelengths in opto-electronic devices, and hard, strong refractory ceramic materials for use in severe temperature environments.

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KEYWORDS: Creep resistant fibers, engine materials, oxygen-resistant

AF01T008 TITLE: High Temperature, High Bandwidth, Pressure Transducer

TECHNOLOGY AREAS: Materials / Processes

OBJECTIVE: Develop and demonstrate a high frequency response pressure transducer capable of operating at 1100 C or higher.

DESCRIPTION: Jet engine turbines operate in a high temperature environment with high frequency pressure and temperature variations caused by combustion instabilities, blade-row interactions, and unsteady aerodynamic phenomena. In addition, the turbine operates in a harsh environment with products of combustion present. In order to more completely understand the effects of pressure fluctuations on the operation and lifetime wear of a turbine, a device capable of making unsteady pressure measurements at up to 125 kHz, at temperatures of 2000 F (1100 C) or higher (up to 1400 C would be desirable) and pressures up to 750 psi (5170 kPa) absolute, with combined uncertainties of less than 1% of full scale is desired. It is envisioned that such a device could be based on a high temperature fiber optic lead coupled to either an optical etalon or a MEMS-based sensor. This will require research and development efforts involving the use of high temperature fiber optics or MEMS substrates, fabrication techniques, coating materials, and device design, calibration and stability characterization, etc. The resulting device would be a surface mounted pressure transducer for use on turbine vanes or casing walls and would provide a point measurement of the unsteady pressure fluctuation in the turbine at the surface of a vane or casing wall. These measurements would be useful both in test rig applications, and in lifetime wear characterization for operating engines. Ideally, this device would be insensitive to temperature variations, or would include a co-located temperature sensor of comparable operating range and frequency response in order to provide temperature corrections. All aspects of the device design and operation should be considered, including calibration, readout fibers or leadwires, corrosion resistance, electronics, and device mounting requirements. The total device must be compact and capable of surviving long duration operation in a turbine engine environment. The device should be minimally intrusive and capable of being flush-mounted on a stator or casing wall with minimal modification to the existing engine components. Ideally the system would be rugged enough to be capable of applications in flight. Device bandwidth, operational temperature, sensitivity, compactness, mounting requirements, calibration requirements, and ruggedness of the design will all be considered in evaluating candidate sensor concepts, and should be addressed in the proposed effort.

PHASE I: Conceptually design the pressure sensors and develop preliminary estimates of frequency response, accuracy and upper limits of temperature operating range. Test preliminary designs and demonstrate the survivability of the sensor components and/or materials by testing samples in lab-level demonstrations at elevated temperatures and pressures.

PHASE II: Build and test a working prototype of sensor proposed in Phase I. Characterize the frequency response, accuracy and resolution of the sensor. Test the prototype in a suitable test rig to demonstrate operation at elevated temperatures and pressures.

PHASE III DUAL USE APPLICATIONS: An improved pressure sensor capable of operation in a harsh, high temperature environment would be a useful device in the development of both internal combustion and gas turbine engines. Such a device would provide new experimental validation capabilities in laboratory setups and may also provide for lifetime monitoring of critical engine components in both military and civilian applications.

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KEYWORDS: High Temperature, High Bandwidth, Sensor, Turbine,Temperature, Pressure, Fiberoptics

AF01T009 TITLE: High Frequency Electromagnetic Propagation/Scattering Codes

TECHNOLOGY AREAS: Materials / Processes

OBJECTIVE: New approaches are sought for numerical implementations of high frequency (exceeding 3 GHz) approximations to Maxwell's equations.

DESCRIPTION: Because the numerical solution of the full Maxwell's equations are not in a particularly mature state the prediction of electromagnetic scattering attributes (radar cross sections, etc) of actual-size inventory (theirs and ours) is currently provided by high frequency (exceeding 3 GHz) approximations to Maxwell's equations such as Physical Optics (PO), Physical Theory of Diffraction (PTD) or Geometrical Theory of Diffraction (GTD). Numerical versions of these theories, the widely used code XPATCH being but one example, have various shortcomings and therefore the following improvements in numerical implementations are sought.(i) Correctly predict caustics and shadow boundaries and the wave fields (including creeping waves) which exist past such regions so that the predictions of the high frequency code are more accurate than PO/PTD/GTD in scenarios such as bistatic/multistatic radar distributions;(ii) Effectively incorporate higher order correction terms in the high frequency asymptotic expansion of Maxwell's equations;(iii) Since PO/PTD/GTD depend so crucially on an accurate geometrical description of the scattering object (particularly the normal vectors to the object's surface), produce an algorithm/subroutine which delivers to the main high frequency code the correct surface normals from an object's CAD file regardless of CAD file choices/sources;(iv) Provide a rigorous analysis of the numerical error (discretization-induced dispersion for example) accompanying the proferred implementations.

PHASE I: Compelling new approaches are solicited which provide some or all of the above improvements.

PHASE II: A user-friendly, commercially attractive code capable of handling CAD descriptions of airplane-sized objects.

PHASE III DUAL USE APPLICATIONS: An appropriate dual use application is the prediction of compatibility (minimization of interference) for commercial aircraft antennas including future GPS receivers allowing all-weather landings.

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KEYWORDS: High-Frequency Scattering, Computational Electromagnetics

AF01T010 TITLE: Machine Learning for Record Linkage

TECHNOLOGY AREAS: Information Systems Technology

OBJECTIVE: Develop an approach to rapidly and accurately linking records of related information from web-based information sources using machine learning techniques.

DESCRIPTION: The overwhelming amount of information now available through the internet has increased the need to combine or integrate the data retrieved from these sources in an intelligent and efficient manner. A problem that frequently arises is that even though the data in different sources is related, the objects in the sources are identified in different ways. For example an information agent that extracts and integrates data from various sources on countries needs to be able to recognize that the country that used to be called Zaire is now called the Democratic Republic of Congo, or that the country referred to as 'Denmark' may also be called 'Kingdom of Denmark'. The problem of identifying the same objects across multiple sources is pervasive and occurs anytime records are being linked across sources that were not designed to be used together. The problem occurs in the naming of people, places, organizations, institutions, governments, etc. Most work on record linkage is either done manually or by simple ad hoc rules. The automated approaches to determining mappings between sources take two forms. First, there is work on learning statistical models of the information being linked using techniques such as EM. This work is appropriate for matching very large sources, such as those dealt with by the U.S. Census Bureau [Winkler,1994] that involve hundreds of thousands of records. However, because there is often insufficient data, it cannot be effectively applied when dealing with smaller web-based information sources. Other related work [Cohen,1998] determines the mappings by using information retrieval techniques. The limitation of this approach is that an abbreviation such as "PRC" would not match "Peoples Republic of China." The challenge is to find an approach that minimizes the amount of information required from the user, but still learns the underlying structure of the sources to provide very high accuracy matches.

PHASE I: Develop a machine learning approach to linking records acrosssources and demonstrate the feasibility of the proposed approach.

PHASE II: Build and test a working prototype of the system proposed in Phase I and provide a detailed evaluation of the system.

PHASE III DUAL USE APPLICATIONS: Significant commercial potential given the importance of integrating the huge amount of data on World Wide Web for both commercial and military applications.

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KEYWORDS: Machine learning, Integration of Heterogeneous Data bases, Internet data mining, Internet linking

AF01T011 TITLE: Closed-Loop Flow Control for External Aerodynamics

TECHNOLOGY AREAS: Sensors, Electronics, and Battlespace Environment

OBJECTIVE: Demonstrate an integrated reactive aerodynamic flow control system that can control the pressure distribution and separation over a generic three-dimensional configuration for a range of subsonic and/or transonic flight conditions and vehicle orientations.

DESCRIPTION: Given recent successes in open-loop flow control, separation control, and virtual aerodynamic shaping (the use of aerodynamic flow control devices to significantly alter the flow field in lieu of modification of the physical shape of the body) is now an achievable goal. The use of sensors and actuators to intelligently control flow over aerodynamic surfaces offers the potential of enhanced flight capability for both autonomous and manned air vehicles. Laboratory experiments have demonstrated that flow control devices can yield reduced drag, increased lift, and control of unsteady aerodynamics. These effects could result in reduced fuel consumption, increased range/endurance, increased control authority, control without hinged surfaces, and enhanced maneuverability for future manned and unmanned air vehicles. The purpose of this program is to integrate feedback controller synthesis with aerodynamic flow control methods, which will be required to realize the full benefits of aerodynamic flow control.The integration of feedback control, including sensing some measure of the state of the flow field, is necessary for effectively and efficiently

applying flow control actuation over a range of flight conditions and vehicle attitudes. A method for modeling the flow field and its reaction to control inputs must be developed that is amenable for control law design and evaluation. Given the high-order nature of the differential equations for aerodynamics and the complexity of separated flows, reduced order models will be required. The models can be developed using simulations and/or physical experiments. The necessity for a physical demonstration of the complete system on a representative, possibly sub-scale, air vehicle configuration must be considered.

PHASE I: Assess candidate actuators, sensors, control methodologies and air vehicle platforms for application. Develop approach for modeling aerodynamic flows, including the effects of actuation, sensors, actuators and control law implementation. Determine system benefits of adding feedback to flow control for chosen application. Develop an implementation and test plan for Phase II.

PHASE II: Continue development of aerodynamic flow control approach. Improve models and control law developed in Phase I. Perform a physical demonstration of the complete system on a representative air vehicle platform for a range of subsonic and/or transonic flight conditions and vehicle orientations.

PHASE III DUAL USE APPLICATIONS: Successful development of closed loop aerodynamic flow control will lead to applications for air, land and sea vehicles. Drag reduction will reduce fuel consumption. The control of forces and moments on the maneuvering vehicle will enhance control authority or enable control without the use of hinged surfaces.

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KEYWORDS: Flow control, Feedback control, Unsteady aerodynamics, External aerodynamics, Drag reduction, Separation control

AF01T012 TITLE: Advanced Hearing Protection

TECHNOLOGY AREAS: Biomedical

OBJECTIVE: To develop safe and effective techniques for hearing protection in very high level noise environments.

DESCRIPTION: Power requirements and launching constraints currently require air crews to work in close proximity to aircraft engines that may produce sound pressure levels above 150dB. Several ground crew locations are at positions where the noise levels are 145-150 dB. Current hearing protection, passive plugs and muffs, provide approximately 30 dB of attenuation for the average user. In order to adequately protect the hearing of ground personnel, 50 dB of attenuation is required. Effective hearing protection must not only provide adequate attenuation, but also must be comfortable to wear and in some instances provide voice communication capability. However, a complete blocking of the noise arriving at the eardrum via the ear canal may be insufficient to protect hearing in 150 dB environments, because of bone conduction pathways: More acoustic energy may reach the cochlea via transmission paths through tissue and bone than via the external auditory canal.

PHASE I: Investigate bone and tissue conduction pathways, i.e. flanking paths, to the cochlea and estimate/measure the magnitude of the effects on hearing thresholds. Quantify the magnitude of the bone and tissue conduction path for 150 dB overall sound pressure level 10 Hz-12.5 kHz noise fields. Test and evaluate active noise and active vibration reduction techniques with potential to reduce noise exposure/hearing loss in 150 dB noise fields. Develop methods/techniques to measure air-conducted and bone-conducted noise at the eardrum and/or cochlea and quantify the attenuation performance of hearing protection technologies which may be passive or active and may operate on air-conducted and/or bone/tissue-conducted noise.

PHASE II: Develop, demonstrate, and validate a laboratory prototype system for effective protection of human hearing in 150 dB noise level environments.

PHASE III DUAL USE APPLICATIONS: The techniques and technologies developed under this effort would be used in commercial aviation, in noisy medical procedures such as MRI, and in other high noise environments such as paint stripping, mining, or building construction.

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1. Clark, W. W. & Bohne, B. A. (1999) Effects of noise on hearing. JAMA 281: 1658-9.
2. Henderson, D., et al. (1976) Effects of Noise on Hearing. New York: Raven Press.
3. The Military Audiology Association. Website: www.militaryaudiology.org
4. N.I.H. Consensus Development Statement, 1990. (76. Noise and Hearing Loss), Jan. 22-24, 8 (1) 1-24.

KEYWORDS: Acoustics, Bioacoustics, Noise attenuation, Hearing Protection, Noise-induced hearing loss.

AF01T013 TITLE: Polymer Based Photovoltaic for Space Applications

TECHNOLOGY AREAS: Materials / Processes

OBJECTIVE: This STTR topic will seek to research flexible Polymer Based Photovoltaics that will provide lightweight power generation for Air Force space and terrestrial applications.

DESCRIPTION: Lightweight power generation is required for both advanced space systems and terrestial mobile airbase units for the United States Air Force. Polymer-based photovoltaics offer the potential for light-weight power generation from conformable films. The lightweight feature will be critically important in decreasing the cost of transport and deployment. The flexible feature will be important for efficient stowing prior to deployment as well as for efficient surface area utilization in advanced space concepts such as microsatellites and/or Tech Sat 21 and terrestrial shelters (i.e. mobile hangars and tents). Future durability and reliability in the harsh space and operational environment is an important parameter to consider for these applications. The goal of this research is to achieve flexible photovoltaic structures with an electrical power generation to weight ratio of over 200 Wop/kg at AM0 illumination (space applications) or a power efficiency of over 10% at AM1.5 illumination (terrestrial applications) by utilizing innovative broad spectrum capture concepts and/or improved quantum efficiency light conversion approaches.

PHASE I: Propose and demonstrate innovative material design approaches and concepts for generating efficienct polymer based photovoltaic cells on flexible substrates that would provide a substantial improvement in power generating capability on per weight basis.

PHASE II: Develop the proposed material technology and conduct appropriate testings to validate the appropriateness of the proposed material approaches and/or concepts to provide lightweight polymer based photovoltaic cells on flexible substrate for space power applications.

PHASE III DUAL USE APPLICATIONS: Lightweight flexible photovoltaic for terrestial applications.

REFERENCES:
1. Polymer/Organic Based PV M. Kaneko, "Chapter 13: Photoelectric Conversion by Polymeric and Organic Materials", Handbook of Organic Conductive Molecules and Polymers : Vol. 4. Conductive Polymers: Transport, Photophysics and Applications. Edited by H. S. Nalwa, John Wiley & Sons Ltd., 1997, p. 661-694.

2. PPV/C60 type N. S. Sariciftci, Current Opinion in Solid State and Materials Science, 4, 373-378 (1999).
3. What is needed fromorganic PVs. K. Zwiebel, "Baseline Evaluation of Thin-Film Amorphous Silicon, Copper Indium Diselenide and Cadmium Telluride for the 21st Century" Photovoltaics for the 21st Century, Edited by V. K. Kapur, R. D. McConnell, D. Carlson, G. P. Ceasar, A. Rohatgi, The Electrochemical Society, Inc., 1999, p. 3-15.
4. Photochemical Cell M. Grätzel, "Properties and Applications of Nanocrystalline Electronic Junctions", Handbook of Nanostructured M

KEYWORDS: Flexible polymer based photovoltaic, lightweight power generation

AF01T014 TITLE: Biomimetic Inspired Fibers, Materials, and Properties

TECHNOLOGY AREAS: Materials / Processes

OBJECTIVE: Demonstrate the application, via mimicry, incorporation, adaptation, or replication, of biological silk fibers into the design and construct of novel, high tensile strength, high elasticity, and extremely light weight fibers, composites, and/or materials.

DESCRIPTION: Current studies on protein fibers, or silks, from spiders, Nephila clavipes, and silkworms, Bombyx mori, demonstrated enormously high tensile (or compressive) strength and percent elongation to failure (elasticity). Similar properties and characteristics can be enhanced in novel, ultra-lightweight films, composites, fibers, and polymers by incorporating these biologically inspired constituents. Technical challenges lie not in bulk manufacturing, but rather in producing in vitro protein fibers and films which retain the requisite in vivo properties. The applicability of novel polymeric extrusion processes to the improvement of silk fiber performance should included in the proposed study.The technological elements required to achieve the stated objective most likely exist; therefore, early efforts in this project should address appropriate sequencing, application, and processing of these elements. The materials should be regularly characterized so as to assess the impact of any changes. As the "correct" pathways are determined, the concept of scalability should be considered. Thus, a second step to this project should be incorporating the fiber into a composite, polymer, or other material.

PHASE I: Demonstrate, from pre-identified biological systems (e.g., the N. clavipes or B. mori), the ability to produce, in vitro, ultra-lightweight protein fibers AND films with high tensile strength and elasticity. Assess material properties and characterize the fibers and films. Then, develop a plan for scaling production of the protein fiber and film showing incorporation of either into a composite, polymer, etc. during Phase II.

PHASE II: Incorporate the Phase I biomimetic fibers into a composite, polymer, or other material. Characterize the material properties. Demonstrate that the fibers enhance the tensile strength and elasticity of the fiber-incorporated substance. Further, demonstrate scalability of the production and material processing of the fiber, film, and/or fiber-incorporated substance(s).

PHASE III DUAL USE APPLICATIONS: Ultra-lightweight, highly elastic materials (films, fibers, composites, etc.) with high tensile (compressive) strength would have several commercial and military customers. Applications would include medicine and pharmaceuticals, optics, coatings, automotive and aerospace components, electronics, clothing and apparel, etc.

REFERENCES:
1. Kaplan, D., Adams, W.W., and Farmer, B.L., "Silk Polymers: Materials Science and Biotechnology," ACS Symposium Series 544, 1994.
2. Fahnestock, S.R. and Bedzyk, L.A., "Production of Synthetic Spider Dragline Silk Protein in Pishia pastoris," Appl Microbiology and Biotechnology, 1997.
3. Fahnestock, S.R. and Irwin, S.L., "Synthetic Spider Dragline Silk Proteins and Their Production in Escherichia coli," Appl Microbiology and Biotechnology, 1997.4. Guerette, P.A., et al. "Silk Prope

KEYWORDS: Biomimetics, Composites, Films, Polymers, Fibers, Materials, Novel materials, Emergent behaviors, Material processing, Material characterization

AF01T015 TITLE: Affordable Airframe Life Extension: Designer Corrosion Suppression Technologies

TECHNOLOGY AREAS: Materials / Processes

OBJECTIVE: This STTR topic will seek research on corrosion prevention compounds that can be applied to aging aircraft to suppress corrosion and/or cracking and thereby extend the useful life of the airframe. The research will also include the investigation of properties of these materials relevant to space applications.

DESCRIPTION: The US Air Force fleet consists of a number of aircraft that are operating at or beyond their original design lifetimes. Corrosion has been found in many of these aircraft due to the breakdown of any original protective systems that were present at the time of manufacture. This corrosion attack can dramatically impact maintenance costs, operational risks, and aircraft readiness. Currently, corrosion prevention compounds (CPCs) are often applied to repaired areas during maintenance. These materials were generally not designed specifically for suppression of corrosion, but instead have been adapted to such use. The opportunity exists to apply rational design concepts to the development of corrosion and cracking prevention compounds for aerospace use. This topic will seek research that can lead to the development of compounds whose composition and structure are tuned to be highly effective in delaying the onset of corrosion and/or in the suppression of corrosion, especially that occurring in physically occluded regions on aircraft exposed to a wide range of environments. Compounds that can suppress the propagation of cracks are also of interest. Materials to be protected include AA2024-T3, AA7075-T6, AA7178-T6, and high-strength steel. Research to further understand the material degradation behavior in these environments with a clear connection to a material development effort in a later phase is acceptable.

PHASE I: Propose innovative chemical structures and/or chemical design concepts for corrosion suppression technologies for aerospace materials. Develop initial data demonstrating suppression design concepts on aerospace materials.

PHASE II: Develop the proposed suppression technology and conduct appropriate testing to validate the appropriateness of the proposed chemical structures and/or chemical design concepts for corrosion suppression of aerospace materials and progress toward commercial development of these chemical structures or concepts. Assess the effectiveness of the proposed corrosion suppression technology, identify applicable application processes and intervals.

PHASE III DUAL USE APPLICATIONS: Develop the proposed suppression technology and conduct appropriate testing to validate the appropriateness of the proposed chemical structures and/or chemical design concepts for corrosion suppression of aerospace materials and progress toward commercial development of these chemical structures or concepts. Assess the effectiveness of the proposed corrosion suppression technology, identify applicable application processes and intervals.

REFERENCES:
1. Simon, L., Skennerton, G., Elster, J., Wickswo, J., and Kelly, R., "Quantification of Corrosion Rates in Aircraft Lap Joints Treated With Corrosion Prevention Compounds (CPC)," presented at Aging Aircraft Conference, St. Louis MO (May 2000).
2. Andy Phelps tech report on Amlguard.
3. Lunt, T.T., Brusamarello, V., Scully, J.R., and Hudson, J.L., "Interactions among localized corrosion sites investigated with electrode arrays," Electrochem. Solid State Letters 3:6, 271-274 (2000).
4. Wang, Peye-Shiang; Liang, Ming-Ru; Lee, Sheng-Long; and Lin, Jing-Chie, "Properties of Zn-Ni electrodeposition on aluminum alloys," Corros. Prev. Control 46:2, 27-31 (1999).
5. Child, T.F. and van Ooij, W.J., "Application of silane technology to prevent corrosion of metals and improve paint adhesion," Trans. Inst. Met. Finish. 77:2, 64-70 (1999).

KEYWORDS: Corrosion, corrosion prevention and/or suppression, aerospace aluminum alloys.

AF01T018 TITLE: Corrosion Prevention Coatings

TECHNOLOGY AREAS: Materials / Processes

OBJECTIVE: Develop Tunable Adhesion Coatings ("Release On Command) for Corrosion Prevention in Aging Aircraft

DESCRIPTION: Corrosion of metal structures is estimated to cost many billions of dollars annually. The most common methods of corrosion inhibition or prevention involve the application of heavy surface treatments (paints and primers) or conversion coatings using various metallics that use application and removal techniques that are strictly controlled and regulated due to toxicity and possible carcinogenic properties. Hybrid polymers, such as Ionic self-assembled monolayers (ISAMs), show promise as protective coating materials that offer opportunities for environmentally friendly "release on command" coating systems.The Air Force is seeking new coating systems that reduce the use of volatile organic compounds and hazardous material, such as hexavalent chromium, and offer unique "release on command" properties. The focus of this research is to meet the Air Force's top priority of corrosion protection, and environmental compliance for aging aircraft coating systems. Ionic self-assembled monolayers (ISAMs) are a recently developed , revolutionary technique that allows detailed structural control of materials at the molecular level combined with ease of manufacturing and low cost. A broad range of layer functionality is possible through incorporation of a wide range of inorganic nanoparticles to control of the electronic, conductive, optical, magnetic, thermal and mechanical properties. High performance polymers may allow excellent thermal stability, mechanical properties as well as processability. New coating processes based on ionic self-assembled monolayers and nanoparticles that 1) offer corrosion inhibition on metal alloys without the use of chromium, 2) neither contains nor generates hazardous materials, 3) offer the potential for "release on command" capabilities, and 4) have demonstrated practical application methods including spraying and non-electrolytic brushing are of interest.

PHASE I: A program in this area should address the requirements and goals described above, and provide a demonstration of the viability of the technology developed as proof of concept. Viability of the technology will be quantified in terms the breadth of needs addressed and demonstration of corrosion prevention. The phase one product for a successful effort is the formulation of the coating system, and testing and evaluation of this coating system on aluminum structures.

PHASE II: The product from Phase I would be developed through optimization and scale-up efforts to establish large-scale application and removal techniques of the corrosion inhibitor coating system. The product of this phase of the effort will need to be compatible with USAF current methods of aircraft inspection and maintenance.

PHASE III DUAL USE APPLICATIONS: The development of tunable adhesive coatings under this effort will have significant government and commercial applications. Protecting structures exposed to the environment is of key concern to any number of institutions, both in the private and government sector. The ability to controllably and cleanly apply and remove protective coatings will have significant impacts on the environmental and personnel costs of maintaining large assets. This technology will be especially beneficial to the aircraft and automobile industries.

REFERENCES:
1. G. Decher and J.D. Hong, Makromol. Chem., Makromol. Symp. 46, 321 (1991).
2. O. Onitsuka, A.C. Fou, M. Ferreira, M.F. Rubner, and B.R. Hsieh, J. Appl. Phys.80, 4067 (1996).

KEYWORDS: Corrosion, corrosion prvention, adhesion, aerospace aluminum alloys, aging aircrafts.

BALLISTIC MISSILE DEFENSE ORGANIZATION (BMDO)
SMALL BUSINESS TECHNOLOGY TRANSFER PROGRAM
Submitting Proposals - Instructions

Send an original Phase I proposal packages (an unbound original) by US mail (or any commercial delivery service). Also, it is important that the Company Commercialization Report be included with the proposal. The mailing address follows and the BMDO SBIR/STTR website address is provided.

Ballistic Missile Defense Organization
ATTN: ST/SBIR (BOND)
1725 Jefferson Davis Highway, Suite 809
Arlington, VA 22202

For Administrative HELP ONLY call: **800-WIN-BMDO**
Internet Access: **www.winbmdo.com**

Proposals delivered by other means will not be accepted. Proposals received after the closing date will not be processed. BMDO will acknowledge receipt of proposals, **IF AND ONLY IF**, the proposal includes a self-addressed stamped envelope and a form that needs no more than a signature by BMDO.

Proposers are required to register and submit their entire proposal through the DoD Electronic Submission Website (http://www.dodsbir.net/submission) and, as instructed on the website, to prepare a BMDO Proposal Cover Sheet and Company Commercialization Report to be included in their proposal.

BMDO is working toward developing and deploying a ballistic missile defense system and providing a technology base that will allow the Department of Defense to protect the warfighters against increasingly sophisticated and lethal missiles around the world. BMDO accomplishes these efforts through three broad mission focus areas: Theater Missile Defense (TMD), National Missile Defense (NMD), and Advanced Technology Developments (ATD).

TMD systems respond to and protect U.S. forces, allies, and other countries from existing and emerging short to medium range threat missiles, including cruise missiles. Six Major Defense Acquisition Programs represent the majority of BMDO investments: PATRIOT Advanced Capability-3 (PAC-3), Navy Area Theater Ballistic Missile Defense (TBMD), Theater High-Altitude Area Defense System (THAAD), Navy Theater Wide, Medium Extended Air Defense System (MEADS), and the National Missile Defense (NMD). Also, the Space Based Laser (SBL) has entered into the pre-MDAP stage of the acquisition cycle. NMD is concerned with the possibility of a limited ballistic missile strike against the United States (all 50 states). The key component systems currently under consideration include: ground-based interceptors; ground-based radars; upgraded early-warning radars; forward-based X-Band radars; battle management, command, control, and communications (BMC3); and advanced sensor technology developments. External elements to NMD include the existing early warning satellite system and its planned follow-on: the Space Based Infrared System (SBIRS) system. Finally, BMDO depends on advanced technology developments, of all aspects, to invigorate its ability to implement both TMD and NMD systems in response to increasingly sophisticated ballistic missile threats, to include cruise missiles. Therefore, the continued availability of such advanced technology developments has become an increasingly vital and critical element of the overall BMDO mission.

The intent of BMDO, first and foremost, is to seek out the most innovative technology that might enable a defense against a missile in flight -- lighter, faster, smaller, stronger, more reliable, and less expensive technologies are all of interest. Proposing companies need not know specific details or requirements of possible BMDO systems, research and development goals, or specific technology needs or requirements, but must understand that potential technologies should have application and be relevant to ballistic missile defense at some level. (A better fire extinguisher, although it may be new and innovative and exhibit a potential commercial market, does not support ballistic missile defense requirements at any level.) All topics seek to solicit Research or Research and Development proposals from the small business community. Furthermore, all selections shall demonstrate and involve a degree of technical risk where the technical feasibility of the proposed work has not yet been fully established.

Specifically, **BMDO seeks to invest seed-capital, which supplements private sector co-investment support, in a product with a future market potential (preferably private sector, but not at the exclusion of public interest) and a measurable BMDO benefit.** The BMDO SBIR/STTR Program will neither support nor further develop concepts **already mature enough to compete** for private capital or for mainline government research and development funds. BMDO prefers projects that move technology into the private sector market by a market-oriented small company with the best demonstration of volume commercialization with private sector co-investments. Phase I proposals should focus primarily on the innovation of the proposed technology. Proposals should illustrate the concept or feasibility, and the merit of a Phase II for a prototype or at the very least a proof-of-concept demonstration. Phase II competition will also be judged intensely on future market possibilities and commercialization potential demonstrated. The demonstration of commercialization potential is best evidenced by Phase II funding commitments, public or private, submitted as part of the Phase II proposal. BMDO evaluates the presence of other indicators of commercialization potential, but only: 1) support-in-kind from private sector sources, and/or 2) a company's self-investment are considered appropriate other indicators by BMDO in assessing the private sector commercial potential of Phase II proposals.

BMDO does not specifically require co-investment in Phase II, and expects to make some Phase II awards in which the co-investment is not a factor in the selection decision each year. However, co-investment is strongly encouraged, and historically, the best companies with the best proposals demonstrate the commercialization potential of their technology by exhibiting private sector co-investment support, at some level, **and/or** the commitment of a government program willing, as part of the Phase II, to co-invest and leverage the SBIR/STTR investment at the time of Phase II selection. This co-investment standard is now set by the proposing companies, your competition, by attracting an average of a dollar-for-dollar match (1:1) of private sector co-investment support to the SBIR/STTR funding requested. Those companies, that do not demonstrate the commercial potential of their Phase II technology through a co-investment arrangement and/or other means, do not compete well at BMDO.

Phase II proposals may be submitted anytime, for any amount, in any format after the Effective Date of the Phase I effort. Unique efforts showing time sensitivity or submitted for *FasTrack* will be given due consideration for Phase II start-up funding and Phase I proposals may include a post-Phase I optional tasking that will permit rapid start-up if the Phase II or *FasTrack* application is approved. The latest information on how BMDO implements its *FasTrack* Program may be found at the website address under the *FasTrack* or Frequently Asked Questions (FAQs) sections. Additionally, the preferred contract type for BMDO Phase II awards is Firm-Fixed Price, Level of Effort. All Phase II proposals for BMDO SBIR consideration should be submitted on a Firm-Fixed Price, Level of Effort basis. Although proposed contract type will not affect selection for negotiation, Phase II contracting may be delayed if another contracting type is proposed. Also, any Phase II proposal shall contain the most recent and updated Company Commercialization Report.

BMDO implements a Phase II Enhancement policy across all SBIR selections by providing some initial funding and then matching private sector co-investments at some ratio and up to some ceiling. BMDO reserves the right to provide less funding than the company initially proposes. To encourage the transition of SBIR technology into DoD acquisition programs, additional government, non-SBIR, funding may be applied to any existing BMDO SBIR Phase II contract with no ceiling, under BMDO's Phase II Enhancement policy. These arrangements, however, must be coordinated through the managing agency implementing the contract. Also, a company that exhibits a unique and compelling rationale may receive additional Phase II SBIR funding to attract a significant level of private-sector funding, **in cash**, as co-investment. These Phase II extensions or "add-ons" shall only occur to existing BMDO SBIR Phase II efforts and are treated on a case by case basis. BMDO, on the average, approves only one Phase II extension per year.

A Principal Investigator, at the small business, who is tenured faculty is **NOT** considered primarily employed by a small firm if they receive any compensation from the university while performing the SBIR or STTR contract; any waiver must be requested explicitly with a justification showing a compelling rational and national need; BMDO expects to grant no such waivers.

BMDO intends for a Phase I to be only an examination of the merit of the concept or technology, that still involves technical risk, with a cost under $65,000. Although proposed cost will not affect selection for negotiation, contracting may be delayed if BMDO reduces the proposed cost. **DO NOT** submit the same proposal, or variations thereof, to more than one BMDO topic area; each idea will be judged once in an open competition among all

proposals. Furthermore, BMDO performs numerous cross-reference checks within each solicitation and with other DoD components. It is strongly suggested that you **do not** use the title of the BMDO SBIR Topic as the title of your Phase I or Phase II proposal. Demonstrate more originality than that.

Because BMDO seeks the best nation-wide experts in innovative technology, proposers may suggest technical government reviewers by enclosing a cover letter with the name, organization, address, phone number, and rationale for each suggestion. BMDO promises only to consider the suggestion and reserves the right to solicit other evaluations as needs dictate.

Implementation of DoD's Fast Track Policy at BMDO

Rationale for BMDO's Implementation Plan

The Defense Department's SBIR program has implemented a Fast Track policy for companies which, during their Phase I efforts, attract outside investors (government or private sector) that will match Phase II SBIR funding, in cash, at the matching rates described in the solicitation. Companies that obtain such outside cash investments and qualify for the SBIR Fast Track receive:

- a significantly higher chance of Phase II award, and
- interim funding between Phase I and Phase II, as well as expedited processing, to ensure no significant funding delays between Phases I and II.

The following summarizes how the DoD Fast Track policy is implemented at BMDO. This Implementation Plan is specifically required since the BMDO SBIR Program has evolved to the level that most companies competing for a Phase II award from BMDO obtain private-sector co-investment support – not just companies participating in the Fast Track. In fact, the BMDO SBIR Program, in its decision process for Phase II award selections, uses as a primary selection criterion (but not the only criterion) a company's ability to demonstrate commercial potential by attracting private-sector co-investment support during the performance of the Phase II. The value that BMDO places on this support depends on a number of factors, including the type of co-investment support (e.g. cash, support-in-kind, or self-investment), amount of the matching support, and timing of the matching support.

Thus, implementation of the DoD Fast Track policy at BMDO needs to occur in such a way that Phase II proposals with the greatest commercial potential, as measured by the amount of private-sector co-investment support, receive the highest priority for Phase II award.

BMDO's Fast Track Implementation Plan – "*FasTrack*" – has been in effect since the FY96.1 DoD SBIR solicitation and is approved for implementation by the Under Secretary of Defense for Acquisition and Technology (USD(A&T)).
BMDO's *FasTrack*:

- is consistent with the general principles of the DoD Fast Track policy, described above; and
- has demonstrated a track record of success. Specifically, BMDO implemented its *FasTrack* policy during 1996-2000 using the procedures outlined below, with the approval of the USD(A&T). 36 Phase I projects qualified for BMDO *FasTrack* during this time period -- the highest amount per dollar of SBIR funds of any DoD SBIR component. 35 of these projects were selected for Phase II award and also received interim funding between Phase I and Phase II.

The BMDO *FasTrack* Implementation Plan

a. In General. BMDO implements a *FasTrack* SBIR process for companies which, during their Phase I projects, attract one or more private-sector, outside co-investors that will match Interim SBIR Funding (between

Phase I and Phase II) and Phase II SBIR funding, in cash, and at the matching rates described in subsection (c) below. Such companies shall receive (subject to the qualifications described herein):

(1) Interim Funding of $30,000 to $40,000 between Phase I and Phase II;

(2) BMDO's highest priority for Phase II selection and award; and

(3) An expedited Phase II selection decision and an expedited Phase II award.

Questions about the BMDO *FasTrack*, including any of the provisions discussed below, should be directed to the BMDO SBIR/STTR Program Manager, Mr. Jeff Bond, at 703-604-3538 (FAX -3926). The BMDO SBIR Home Page contains a BMDO *FasTrack* Timeline showing the schedule of events for a company participating in BMDO's *FasTrack* program (see http://www.futron.com/bmdo/3FAST/fasttrk.gif).

b. How to Qualify for BMDO *FasTrack*. To qualify for BMDO *FasTrack*, a company that has received a BMDO-sponsored Phase I award must submit the following five items within four (4) months of the effective date of the Phase I award. (Note: The effective date is the date on which the Phase I contract actually takes effect and the company may begin to incur costs under the contract.):

(1) A completed DoD/BMDO *FasTrack* application form (which follows this Plan). A copy of the completed DoD/BMDO *FasTrack* application must also be sent to the DoD SBIR Program Manager at the address listed on the back of the form.

(2) A Commitment Letter from a private sector, outside co-investor(s) – such as another company, a venture capital firm, or an "angel" investor – stating that the investor(s) will match the Interim Funding and the Phase II funding, **in cash**, at the matching rates listed in subsection (c) below. The investment must qualify as a "Fast Track investment," and the co-investor as an "outside investor," as defined in Reference E of the SBIR solicitation (i.e. the investor cannot be an affiliate of the SBIR company). Additionally, under BMDO *FasTrack*, federal, state, and foreign governments do not qualify as valid co-investors.

The Commitment Letter should state that the co-investor's funds will pay for work that is connected to the specific SBIR project, and should also describe the general nature of that work. The work funded by the co-investor may be additional research and development on the project or, alternatively, it may be other activity related to the project (e.g., marketing) that is outside the scope of the SBIR contract. The co-investor may provide its matching funds to the company contingent on the company's being selected for Phase II (procedures for accomplishing this must be discussed with the BMDO SBIR Program Manager, Mr. Jeff Bond, at 703/604-3538).

(3) A concise Statement of Work and Cost Proposal for the Interim Funding effort (typically less than 4 pages in length).

(4) An Executive Summary of the current status of the Phase I effort (typically less than 4 pages in length).

(5) A copy of the first page of the Phase I contract (i.e. the signature page).

Additionally:

(1) The company must submit its Phase II proposal within five (5) months of the effective date of the Phase I award;

(2) The company must submit a Private Sector Investment Certification (PSIC) within seven (7) months of the effective date of the Phase I award, indicating that the co-investor's matching funds have been transferred to the SBIR company. The PSIC consists of: (a) a letter, signed by the co-investor and the company, that states the amount of cash that has been transferred; and (b) documentation to substantiate that the transfer of funds has occurred (e.g. a bank statement, wire transfer, or copies of canceled checks).

If not all the co-investor's funds are transferred to the company by the end of the seventh month, the company will still qualify for the *FasTrack*. However, it will receive a lower preference for Phase II selection than other *FasTrack* participants, as described in subsection (e) below. Additionally, BMDO will match co-investor funds transferred to the company after the seventh month at only a $1 to $1 matching rate, rather than at the more favorable matching rates listed in subsection (c) below. Also, BMDO will only provide installments of Phase II funds to the company after corresponding installments of matching funds have been transferred from the co-investor to the company. (e.g. The company and investor must certify that $60,000 in matching funds has been transferred to the company before BMDO will release a corresponding $60,000 installment of Phase II SBIR funds.)

A company which fails to meet these conditions in their entirety within the time frames indicated will generally be disqualified from BMDO *FasTrack* consideration. If disqualified, the company shall still be eligible to compete for a "standard" Phase II award through the regular BMDO Phase II procedures with no penalty.

c. Matching Rates. BMDO *FasTrack* matching rates differ slightly from the matching rates under the DoD Fast Track policy. The BMDO rates are as follows:

(1) For SBIR companies that have 10 or fewer employees **and** have never received a Phase II SBIR or STTR award from any federal agency, the co-investor's Commitment Letter must state that the co-investor shall provide at least $1 to match every $4 of Interim SBIR Funding and Phase II funding. (e.g. If the company proposes Interim SBIR Funding of $40,000 and Phase II SBIR funding of $600,000, the co-investor must provide a commitment of matching funds of $10,000 and $150,000 respectively for the two efforts.)

(2) For SBIR companies that have received fewer than five (5) Phase II SBIR/STTR awards from the federal government, and do not fall into category (1) above, the co-investor's Commitment Letter must state that the co-investor shall provide at least $1 to match every $2 of Interim SBIR Funding and Phase II funding. (e.g. If the company proposes Interim SBIR Funding of $40,000 and Phase II SBIR funding of $600,000, the investor must provide a commitment of matching funds of $20,000 and $300,000 respectively for the two efforts.)

(3) For SBIR companies that have received five (5) Phase II SBIR/STTR awards or more from the federal government, the co-investor's Commitment Letter must state that the co-investor shall provide at least $1 to match every $1 of Interim SBIR Funding and Phase II funding. (e.g. If the company proposes Interim SBIR Funding of $40,000 and Phase II SBIR funding of $600,000, the investor must provide a commitment of matching funds of $40,000 and $600,000 respectively for the two efforts.)

d. Benefits of Qualifying for BMDO *FasTrack*. A company that qualifies for BMDO *FasTrack* will:

(1) Receive Interim Funding of $30,000 to $40,000 between Phase I and Phase II (However, the Interim Funding plus the Phase I award shall not exceed $100,000).

(2) Receive BMDO's highest priority for selection for Phase II award. Specifically, BMDO shall select the company for Phase II award assuming its project meets or exceeds a "technically sufficient" level, as described in Section 4.3 of the current solicitation. As discussed in subsection (e) below, among *FasTrack* companies, those that receive all of their co-investor matching funds within seven months after the effective start date of Phase I receive higher preference for selection than *FasTrack* companies that receive some or all matching funds after the seventh month.

(3) Receive notification of whether it has been selected for Phase II award within 60 days after the completion of its Phase I project.

(4) If selected, receive its Phase II award within an average of five months after the completion of its Phase I project, to ensure no significant funding delay between Phase I and Phase II. (Note: Although BMDO makes all of its Phase II selection decisions, the Phase II contracts are processed by other DoD organizations, and BMDO therefore does not directly control the timing of the contract awards. However,

most BMDO *FasTrack* awards have been made within five months after the completion of the Phase I effort.)

e. BMDO *FasTrack* Preference Levels. As discussed above, companies that qualify for the BMDO *FasTrack* receive BMDO's highest priority for Phase II selection and award. Among *FasTrack* companies, those that receive all of their co-investor matching funds within seven months after the effective start date of Phase I receive higher preference for selection than *FasTrack* companies that receive some or all matching funds after the seventh month, as follows:

Preference Level 1 applies to *FasTrack* companies that receive **all** of the matching funds for the Interim effort and the Phase II effort within seven months after the effective start date of the Phase I award.

Preference Level 2 applies to *FasTrack* companies that receive all of the matching funds for the Interim effort but only some of the matching funds for the Phase II effort within seven months after the effective start date of the Phase I award.

Preference Level 3 applies to *FasTrack* companies that receive all the matching funds for the Interim effort but none of the matching funds for the Phase II effort within seven months after the effective start date of the Phase I award.

BMDO FY01 STTR TOPIC DESCRIPTION

BMDO 01T-001 Electronics and Photonics

Introduction: In implementing its TMD and NMD program activities, BMDO is continuing its developments of such efforts as the PATRIOT Advanced Capability-3 (PAC-3) missile system which has four major systems components: radar, engagement control station, launching station, and interceptors. The Navy Area Wide system will develop a sea-based capability that builds upon the existing AEGIS/Standard Missile air defense system. This system is based on the AEGIS-class cruisers and destroyers, which provide all elements of missile defense and are particularly suited to protecting forces moving inland from the sea. The Theater High-Altitude Area Defense System (THAAD) system will form the largest umbrella of missile protection in a specific theater, arching over all other missile defense systems. THAAD consists of four major systems components: truck-mounted launchers; interceptors; radar system; and battle management, command, control, communications, and intelligence (BMC3I). These increasingly sophisticated systems will provide the opportunity to destroy short and medium range ballistic missiles and other threats in the atmosphere far enough away that falling debris will not endanger friendly forces. The various BMDO technology and acquisition programs, in support of the TMD and NMD missions, are continually evaluating the latest advanced technology developments from industry as potential replacements for the current state-of-the-art sensor systems, components, sub-components, or piece part specifics. Research or Research and Development efforts selected under this topic shall demonstrate and involve a degree of technical risk where the technical feasibility of the proposed work has not been fully established.

Description: The necessary advances in electronics for the many ballistic missile defense applications will require advances in electronics materials. Primary emphasis lies in advancing the capability of integrated circuits, detectors, sensors, large-scale integration, radiation hardness, and all electronic components. Novel quantum-well/superlattice structures that allow the realization of unique elective properties through "band gap engineering" are sought, as are new organic and polymer materials with unique electronic characteristics. In addition, exploitation of the unusual electronic properties of gallium nitride is of considerable interest. Specifically, under high speed switching conditions at >10GHz and/or cryogenic temperatures. Among the many BMDO electronic needs and interest are advances in high frequency transistor structures, solid state lasers, optical detectors, low dielectric constant packaging materials, tailored thermal conductivity, microstructural waveguides, multilayer capacitors, single-electron transistors, metallization methods for repair of conducting paths in polyceramic systems, and sol-gel processing for packaging materials.

Also, dense computing capability is sought in all architectural variations, from all optic to hybrid computers. Specific examples of areas to be addressed include, but are not limited to, high speed multiplexing, monolithic optoelectronic transmitters, holographic methods, reconfigurable interconnects, optoelectronic circuits,

and any other technology contributing to advances in intra-computer communications, optical logic gates, bistable memories, optical transistors, and power limiters. Non-linear optical materials advancements and new bistable optical device configurations.

Phase I: Demonstrate the likelihood that a new and innovative research and development approach can meet any of the broad needs discussed in this topic for future BMDO systems consideration.

Phase II: Develop applicable and feasible prototype demonstrations and/or proof-of-concept devices for the approach described, and demonstrate a degree of commercial viability.

Successful Phase 3/Dual-Use Commercializers (Real-World Examples): Company Y, with a market cap of $693M+, commercialized technology that allowed for the delivery of ultra-pure materials to semiconductor thin film reactors and has graduated from small business status. Company Z, with a market cap of $7M+, manufactures radiation detection devices and was funded for avalanche photodiode arrays under this topic. Company AA, with a market cap of $216M+, has a substantial market share of the atomic layer epitaxy growth method of semiconductor compound materials based on their efforts developed under this topic. Company BB, with a market cap of $273M+, which manufactures flat panel display devices, received some initial funding for their silicon-on-insulator films and organometallic chemical vapor deposition technology developments. Company CC, with a market cap of $178M+, commercialized technology based on degradation resistant laser diodes. Company DD, with a market cap of $30M+, is commercializing technology based on its surge suppression devices and marketed as SurgX. Company EE, with a market cap of $1,776M+, had initial funding for its high bandgap compounds and laser diode products to develop a number of commercial and military products, and has graduated from small business status. Company KK established a multilayer coating technology that can be easily transported to any location for application. Company FF developed a magnetoresistive non-volatile random access memory chip, which is also radiation hardened, and is utilized in a number of space applications for the military and commercial sectors. Company LL, with a market cap of $26M+, was started with their first Phase I from this topic and the products are used in electronics, structural ceramics, composites, cosmetics and skin care, and as industrial catalysts. Company NN, with a market cap of $510M+, is leveraging technology developed under this topic for the efficient production of semiconductors from waste recovery during the manufacturing process. Company R took a unique technology approach in addressing fiber-optic and other optical communications applications to both the military and commercial industry. Company S is providing a low-loss electro-optical switching array, Company T is providing optical bus extenders and fiber-optic modulators, Company U has funded technology which utilized wavelength division multiplexing techniques; all three support the ever growing optical communication industry.

DoD Key Technology Areas: Air Platforms, Information Systems Technology, Materials/Processes, Sensors, Electronics, Battlespace Environment, Space Platforms, Weapons, Nuclear Technology

9.0 SUBMISSION FORMS AND CERTIFICATIONS

Section 9.0 contains:

Reference A: **Cost Proposal Outline**
A cost proposal following the format in Reference A must be included with each proposal submitted.

Reference B: **Fast Track Application Form**
A DoD program under which projects that attract outside investors receive interim funding and selection for Phase II award provided they are "technically sufficient" and have substantially met Phase I goals.

Reference C: **Model Agreement for the Allocation of Intellectual Property and Follow-on Rights**
This is only a model provided as a guideline for the small business in the development of an agreement that allocates intellectual property rights and rights to follow-on research, development, or commercialization between the small business and the research institution (see Section 3.4.o for more details). The small business is not required to use this model agreement, in whole or part, for its agreement with the research institution. A written agreement between the small business and research institution need not be submitted with the proposal, but must be available upon request.

Reference D: **Proposal Receipt Notification Form**

Reference E: **Directory of Small Business Specialists**

Reference F: **SF 298 Report Documentation Page**

Reference G: **DoD Fast Track Guidance**

Reference H: **List of Eligible FFRDCs**

Reference I: **DoD SBIR/STTR Mailing List Form**

U.S. DEPARTMENT OF DEFENSE
SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM
COST PROPOSAL

Background:

Offerors should indicate the following terms, as appropriate, in their proposal, following the instructions in Section 3.4(m) of this solicitation.

Cost Breakdown Items (in this order, as appropriate):

1. Name of offeror
2. Home office address
3. Location where work will be performed
4. Title of proposed effort
5. Company's taxpayer identification number and CAGE code. *(Note: Offerors that do not yet have these items -- e.g., because the company does not yet exist at the time of proposal submission -- should so indicate in the cost proposal. Such offerors, if selected for award, should talk with their DoD contracting officer about obtaining these items, both of which are required before a contract can be awarded.)*
6. Topic number and topic title from DoD Solicitation Brochure
7. Total dollar amount of the proposal
8. Direct material costs
    a. Purchased parts (dollars)
    b. Subcontracted items (dollars)
    c. Other
        (1) Raw material (dollars)
        (2) Your standard commercial items (dollars)
        (3) Interdivisional transfers (at other than cost dollars)
    d. Total direct material (dollars)
9. Material overhead (rate_____%) x total direct material = dollars
10. Direct labor (specify)
    a. Type of labor, estimated hours, rate per hour and dollar cost for each type (e.g., "computer programmer, 40 hours, $26 per hour, $1040 cost"). Include the name as well as hours, etc. of all key personnel.
    b. Total estimated direct labor (dollars)
11. Labor overhead
    a. Identify overhead rate, the hour base and dollar cost
    b. Total estimated labor overhead (dollars)
12. Special testing (include field work at government installations)
    a. Provide dollar cost for each item of special testing
    b. Estimated total special testing (dollars)
13. Special equipment
    a. If direct charge, specify each item and cost of each
    b. Estimated total special equipment (dollars)
14. Travel (if direct charge)
    a. Transportation (detailed breakdown and dollars)
    b. Per diem or subsistence (details and dollars)
    c. Estimated total travel (dollars)
15. Subcontracts (eg., consultants)
    a. Identify each, with purpose, and dollar rates
    b. Total estimated consultants costs (dollars)
16. Other direct costs (specify)
    a. Total estimated direct cost and overhead (dollars)
17. General and administrative expense
    a. Percentage rate applied
    b. Total estimated cost of G&A expense (dollars)
18. Royalties (specify)
    a. Estimated cost (dollars)
19. Fee or profit (dollars)
20. Total estimate cost and fee or profit (dollars)
21. The cost breakdown portion of a proposal must be signed by a responsible official, and the person signing must have typed name and title and date of signature must be indicated.
22. On the following items offeror must provide a yes or no answer to each question.
    a. Has any executive agency of the United State Government performed any review of your accounts or records in connection with any other government prime contract or subcontract within the past twelve months? If yes, provide the name and address of the reviewing office, name of the individual and telephone extension.
    b. Will you require the use of any government property in the performance of this proposal? If yes, identify.
    c. Do you require government contract financing to perform this proposed contract? If yes, then specify type as advanced payments or progress payments.
23. Type of contract proposed, either cost-plus-fixed-fee or firm-fixed price.

U.S. DEPARTMENT OF DEFENSE

SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM

FAST TRACK APPLICATION FORM

Failure to fill in all appropriate spaces may cause your proposal to be disqualified

FAST TRACK PROGRAM QUALIFICATIONS (see Section 4.5 of the solicitation for detailed explanation)
To qualify for the STTR Fast Track, a company must submit a Fast Track application and meet the other requirements detailed in Section 4.5 of the solicitation. This form, when completed and signed by both the company and its investor, should be included as the cover sheet of the Fast Track application. Instructions on where to submit the application are on the back of this form.

TOPIC #:	CONTRACT #:	PHASE I EFFECTIVE START DATE:	PHASE I COMPLETION DATE:
PHASE I TITLE:			
FIRM:		TAXPAYER ID#:	
STREET:			
CITY:	STATE:	ZIP:	
OUTSIDE INVESTOR:		TAXPAYER ID#:	
STREET:			
CITY:	STATE:	ZIP:	

BUSINESS CERTIFICATION:

	YES	NO
▸ Has your company ever received a Phase II SBIR or STTR award from the federal government (including DoD)? If yes, the minimum matching rate is $1 for every STTR dollar. If no, the minimum matching rate is 25 cents for every STTR dollar.	☐	☐
▸ Does the outside funding proposed in this application qualify as a "Fast Track investment", and does the investor quality as an "outside investor", as defined in DoD Fast Track Guidance (Reference G)? If you have any questions about this, call the DoD SBIR/STTR Help Desk (800-382-4634). The Help Desk will refer any policy and/or substantive questions to appropriate DoD personnel for an official response.	☐	☐

Caution: knowingly and willfully making any false, fictitious, or fraudulent statements or representations above may be felony under the Federal Criminal False Statement Act (18 U.S.C. Sec 1001), punishable by a fine of up to $10,000, up to five years in prison, or both.

PROPOSED STTR AND MATCHING FUNDS:

- ▸ Proposed DoD STTR funds for the interim effort: $_____
- ▸ Proposed DoD STTR funds for Phase II: $_____
- ▸ Total proposed DoD STTR funds (interim + Phase II): $_____
- ▸ Amount of matching funds (cash) the investor will provide: $_____

By signing below, the parties are stating that the outside investor will provide matching funds, in the amount listed above, contingent on the company's selection for Phase II STTR award. If the matching funds are not transferred from the investor to the company within 45 days after DoD has notified the company that it has been selected for Phase II award, the company will be ineligible to compete for a Phase II award not only under the Fast track but also under the regular Phase II competition, unless a specific written exception is granted by the Component STTR program manager.

FIRM OFFICIAL	OUTSIDE INVESTOR OFFICIAL
NAME:	NAME:
TITLE:	TITLE:
TELEPHONE:	TELEPHONE:
SIGNATURE: DATE:	SIGNATURE: DATE:

INSTRUCTIONS FOR COMPLETING REFERENCE B

SUBMISSION:

Submit the Fast Track application, including the three items discussed in Section 4.5(b), to the technical monitor for your Phase I project. In addition, submit a copy of the entire application to the Program Manager of the DoD Component funding the STTR project (addresses below). Finally, send a copy of this application cover sheet, when completed, to the DoD SBIR/STTR Program Manager, OSD/SADBU, 177 N. Kent Street, Suite 9100, Arlington, VA 22209. Do not submit other items in the Fast Track application to the DoD STTR Program Manager.

Department of the Army
Director, Army Research Office
ATTN: AMXRO-RT (Ltc. Ken Jones)
4300 S. Miami Boulevard
Research Triangle Park, NC 27709

Ballistic Missile Defense Organization
ATTN: TOI/STTR (Bond)
1725 Jefferson Davis Highway
Suite 809
Arlington, VA 22202

Department of the Navy
ONR 362 STTR
ATTN: John Williams
800 N. Quincy Street
Arlington, VA 22217-5660

Department of the Air Force
AFPL/XPTT, Steve Guilfoos
1864 4th Street, Suite 1, Bldg. 15
Wright Patterson AFB, OH 45433-7131

REQUEST FOR COPIES OF THIS FORM:

Additional forms may be obtained from:

DoD SBIR/STTR Support Services
2850 Metro Drive, Suite 600
Minneapolis, MN 55425-1566
(800) 382-4634

U.S. DEPARTMENT OF DEFENSE

SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM

FAST TRACK APPLICATION FORM

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PHASE I TITLE:			
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STREET:			
CITY:	STATE:	ZIP:	
OUTSIDE INVESTOR:		TAXPAYER ID#:	
STREET:			
CITY:	STATE:	ZIP:	

BUSINESS CERTIFICATION:

	YES	NO
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NAME:	NAME:
TITLE:	TITLE:
TELEPHONE:	TELEPHONE:
SIGNATURE: DATE:	SIGNATURE: DATE:

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ONR 362 STTR
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1725 Jefferson Davis Highway
Suite 809
Arlington, VA 22202

Department of the Air Force
AFPL/XPTT, Steve Guilfoos
1864 4th Street, Suite 1, Bldg. 15
Wright Patterson AFB, OH 45433-7131

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2850 Metro Drive, Suite 600
Minneapolis, MN 55425-1566
(800) 382-4634

SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM

ALLOCATION OF RIGHTS IN INTELLECTUAL PROPERTY AND RIGHTS TO CARRY OUT FOLLOW-ON RESEARCH, DEVELOPMENT, OR COMMERCIALIZATION

(This is only a model)

This Agreement between _____, a small business concern organized as a _____ under the laws of _____ and having a principal place of business at _____, ("SBC") and _____, a research institution having a principal place of business at _____, ("RI") is entered into for the purpose of allocating between the parties certain rights relating to an STTR project to be carried out by SBC and RI (hereinafter referred to as the "PARTIES") under an STTR funding agreement that may be awarded by _____ ("AGENCY") to SBC to fund a proposal entitled "_____" submitted, or to be submitted, to AGENCY by SBC on or about _____, 20 _____.

1. Applicability of this Agreement.

(a) This Agreement shall be applicable only to matters relating to the STTR project referred to in the preamble above.

(b) If a funding agreement for an STTR project is awarded to SBC based upon the STTR proposal referred to in the preamble above, SBC will promptly provide a copy of such funding agreement to RI, and SBC will make a subaward to RI in accordance with the funding agreement, the proposal, and this Agreement. If the terms of such funding agreement appear to be inconsistent with the provisions of this Agreement, the PARTIES will attempt in good faith to resolve any such inconsistencies. However, if such resolution is not achieved within a reasonable period, SBC shall not be obligated to award nor RI to accept the subaward. If a subaward is made by SBC and accepted by RI, this Agreement shall not be applicable to contradict the terms of such subaward or of the funding agreement awarded by AGENCY to SBC except on the grounds of fraud, misrepresentation, or mistake, but shall be considered to resolve ambiguities in the terms of the subaward.

(c) The provisions of this Agreement shall apply to any and all consultants, subcontractors, independent contractors, or other individuals employed by SBC or RI for the purposes of this STTR project.

2. Background Intellectual Property.

(a) "Background Intellectual Property" means property and the legal right therein of either or both parties developed before or independent of this Agreement including inventions, patent applications, patents, copyrights, trademarks, mask works, trade secrets and any information embodying proprietary data such as technical data and computer software.

(b) This Agreement shall not be construed as implying that either party hereto shall have the right to use Background Intellectual Property of the other in connection with this STTR project except as otherwise provided hereunder.

(1) The following Background Intellectual Property of SBC may be used nonexclusively and, except as noted, without compensation by RI in connection with research or development activities for this STTR project (if "none" so state): _____;

(2) The following Background Intellectual Property of RI may be used nonexclusively and, except as noted, without compensation by SBC in connection with research or development activities for this STTR project (if "none" so state): _____;

(3) The following Background Intellectual Property of RI may be used by SBC nonexclusively in connection with commercialization of the results of this STTR project, to the extent that such use is reasonably necessary for practical, efficient and competitive commercialization of such results but not for commercialization independent of the commercialization of such results, subject to any rights of the Government therein and upon the condition that SBC pay to RI, in addition to any other royalty including any royalty specified in the following list, a royalty of % of net sales or leases made by or under the authority of SBC of any product or service that embodies, or the manufacture or normal use of which entails the use of, all or any part of such Background Intellectual Property (if "none" so state): _____.

3. Project Intellectual Property.

(a) "Project Intellectual Property" means the legal rights relating to inventions (including Subject Inventions as defined in 37 CFR ∋ 401), patent applications, patents, copyrights, trademarks, mask works, trade secrets and any other legally protectable information, including computer software, first made or generated during the performance of this STTR Agreement.

(b) Except as otherwise provided herein, ownership of Project Intellectual Property shall vest in the party whose personnel conceived the subject matter or first actually reduced the subject matter to practice, and such party may perfect legal protection therein in its own name and at its own expense. Jointly made or generated Project Intellectual Property shall be jointly owned by the PARTIES unless otherwise agreed in writing. The SBC shall have the first option to perfect the rights in jointly made or generated Project Intellectual Property unless otherwise agreed in writing.

(1) The ownership, including rights to any revenues and profits, resulting from any product, process, or other innovation or invention based on the cooperative shall be allocated between the SBC and the RI as follows:
SBC Percent: ____ RI Percent: ____

(2) Expenses and other liabilities associated with the development and marketing of any product, process, or other innovation or invention shall be allocated as follows:
SBC Percent: ____ RI Percent: ____

(c) The PARTIES agree to disclose to each other, in writing, each and every Subject Invention, which may be patentable or otherwise protectable under the United States patent laws in Title 35, United States Code. The PARTIES acknowledge that they will disclose Subject Inventions to each other and the awarding agency within ___ months after their respective inventor(s) first disclose the invention in writing to the person(s) responsible for patent matters of the disclosing Party. All written disclosures of such inventions shall contain sufficient detail of the invention, identification of any statutory bars, and shall be marked confidential, in accordance with 35 U.S.C. ∋ 205.

(d) Each party hereto may use Project Intellectual Property of the other nonexclusively and without compensation in connection with research or development activities for this STTR project, including inclusion in STTR project reports to the AGENCY and proposals to the AGENCY for continued funding of this STTR project through additional phases.

(e) In addition to the Government's rights under the Patent Rights clause of 37 CFR ∋ 401.14, the PARTIES agree that the Government shall have an irrevocable, royalty free, nonexclusive license for any governmental purpose in any Project Intellectual Property.

(f) SBC will have an option to commercialize the Project Intellectual Property of RI, subject to any rights of the Government therein, as follows--

(1) Where Project Intellectual Property of RI is a potentially patentable invention, SBC will have an exclusive option for a license to such invention, for an initial option period of ____ months after such invention has been reported to SBC. SBC may, at its election and subject to the patent expense reimbursement provisions of this section, extend such option for an additional ____ months by giving written notice of such election to RI prior to the expiration of the initial option period. During the period of such option following notice by SBC of election to extend, RI will pursue and maintain any patent protection for the invention requested in writing by SBC and, except with the written consent of SBC or upon the failure of SBC to reimburse patenting expenses as required under this section, will not voluntarily discontinue the pursuit and maintenance of any United States patent protection for the invention initiated by RI or of any patent protection requested by SBC. For any invention for which SBC gives notice of its election to extend the option, SBC will, within __ days after invoice, reimburse RI for the expenses incurred by RI prior to expiration or termination of the option period in pursuing and maintaining (i) any United States patent protection initiated by RI and (ii) any patent protection requested by SBC. SBC may terminate such option at will by giving written notice to RI, in which case further accrual of reimbursable patenting expenses hereunder, other than prior commitments not practically revocable, will cease upon RI's receipt of such notice. At any time prior to the expiration or termination of an option, SBC may exercise such option by giving written notice to RI, whereupon the parties will promptly and in good faith enter into negotiations for a license under RI's patent rights in the invention for SBC to make, use and/or sell products and/or services that embody, or the development, manufacture and/or use of which involves employment of, the invention. The terms of such license will include: (i) payment of reasonable royalties to RI on sales of products or services which embody, or the development, manufacture or use of which involves employment of, the invention; (ii) reimbursement by SBC of expenses incurred by RI in seeking and maintaining patent protection for the invention in countries covered by the license (which reimbursement, as well as any such patent expenses incurred directly by SBC with RI's authorization, insofar as deriving

from RI's interest in such invention, may be offset in full against up to _____ of accrued royalties in excess of any minimum royalties due RI); and, in the case of an exclusive license, (iii) reasonable commercialization milestones and/or minimum royalties.

(2) Where Project Intellectual Property of RI is other than a potentially patentable invention, SBC will have an exclusive option for a license, for an option period extending until ___ months following completion of RI's performance of that phase of this STTR project in which such Project Intellectual Property of RI was developed by RI. SBC may exercise such option by giving written notice to RI, whereupon the parties will promptly and in good faith enter into negotiations for a license under RI's interest in the subject matter for SBC to make, use and/or sell products or services which embody, or the development, manufacture and/or use of which involve employment of, such Project Intellectual Property of RI. The terms of such license will include: (i) payment of reasonable royalties to RI on sales of products or services that embody, or the development, manufacture or use of which involves employment of, the Project Intellectual Property of RI and, in the case of an exclusive license, (ii) reasonable commercialization milestones and/or minimum royalties.

(3) Where more than one royalty might otherwise be due in respect of any unit of product or service under a license pursuant to this Agreement, the parties shall in good faith negotiate to ameliorate any effect thereof that would threaten the commercial viability of the affected products or services by providing in such license(s) for a reasonable discount or cap on total royalties due in respect of any such unit.

4. Follow-on Research or Development.

All follow-on work, including any licenses, contracts, subcontracts, sublicenses or arrangements of any type, shall contain appropriate provisions to implement the Project Intellectual Property rights provisions of this agreement and insure that the PARTIES and the Government obtain and retain such rights granted herein in all future resulting research, development, or commercialization work.

5. Confidentiality/Publication.

(a) Background Intellectual Property and Project Intellectual Property of a party, as well as other proprietary or confidential information of a party, disclosed by that party to the other in connection with this STTR project shall be received and held in confidence by the receiving party and, except with the consent of the disclosing party or as permitted under this Agreement, neither used by the receiving party nor disclosed by the receiving party to others, provided that the receiving party has notice that such information is regarded by the disclosing party as proprietary or confidential. However, these confidentiality obligations shall not apply to use or disclosure by the receiving party after such information is or becomes known to the public without breach of this provision or is or becomes known to the receiving party from a source reasonably believed to be independent of the disclosing party or is developed by or for the receiving party independently of its disclosure by the disclosing party.

(b) Subject to the terms of paragraph (a) above, either party may publish its results from this STTR project. However, the publishing party will give a right of refusal to the other party with respect to a proposed publication, as well as a ___ day period in which to review proposed publications and submit comments, which will be given full consideration before publication. Furthermore, upon request of the reviewing party, publication will be deferred for up to _____ additional days for preparation and filing of a patent application which the reviewing party has the right to file or to have filed at its request by the publishing party.

6. Liability.

(a) Each party disclaims all warranties running to the other or through the other to third parties, whether express or implied, including without limitation warranties of merchantability, fitness for a particular purpose, and freedom from infringement, as to any information, result, design, prototype, product or process deriving directly or indirectly and in whole or part from such party in connection with this STTR project.

(b) SBC will indemnify and hold harmless RI with regard to any claims arising in connection with commercialization of the results of this STTR project by or under the authority of SBC. The PARTIES will indemnify and hold harmless the Government with regard to any claims arising in connection with commercialization of the results of this STTR project.

7. Termination.

(a) This agreement may be terminated by either Party upon ___ days written notice to the other Party. This agreement may also be terminated by either Party in the event of the failure of the other Party to comply with the terms of this agreement.

(b) In the event of termination by either Party, each Party shall be responsible for its share of the costs incurred through the effective date of termination, as well as its share of the costs incurred after the effective date of termination, and which are related to the termination. The confidentiality, use, and/or non-disclosure obligations of this agreement shall survive any termination of this agreement.

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11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE

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DoD Fast Track Guidance

This paper contains DoD's official guidance on what types of relationships between a small company and outside investors in the company qualify as an investment under the SBIR and STTR Fast Track ("Fast Track investment"). It includes specific examples of company-investor relationships that we have been asked about and our official responses on whether these relationships qualify as a Fast Track investment. If you have questions about whether a particular company-investor relationship qualifies, please contact the DoD SBIR/STTR Help Desk (tel. 800/382-4634, fax 800/462-4128, e-mail SBIRHELP@teltech.com). The Help Desk will refer any policy or substantive questions to appropriate DoD personnel for an official response.

I. General Guidance on What Qualifies As A "Fast Track Investment"

- The investor must be an **outside** investor, which may include such entities as another company, a venture capital firm, an individual "angel" investor, a non-SBIR/non-STTR government program, or any combination of the above. It does not include the owners of the small business, their family members, and/or "affiliates" of the small business, as defined in Title 13 of the *Code of Federal Regulations* (C.F.R.), Section 121.103. As discussed in that Section:
  - ▶ Concerns are affiliates of each other when one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.
  - ▶ [We] consider factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists.
  - ▶ Individuals or firms that have identical or substantially identical business or economic interests, such as family members, persons with common investments, or firms that are economically dependent through contractual or other relationships, may be treated as one party with such interests aggregated.

  Although DoD is guided by this definition of affiliation in the Code of Federal Regulations, we also exercise our own discretion whether a particular entity qualifies as an "outside investor".

- The **investment** must be an arrangement in which the outside party provides cash to the small company in return for such items as: equity; a share of royalties; rights in the technology; a percentage of profit; an advance purchase order for products resulting from the technology; or any combination of the above.

II. Specific examples of What Does and Does Not Qualify As a "Fast Track Investment"

A. Examples of What Qualifies as an "Outside" Investor"

(1) Can a small company contribute its own internal funds to qualify for the Fast Track?

No. DoD is seeking outside validation of the commercial potential of the company's technology, and therefore requires that the funds come from an outside investor. Also, cash from an outside investor shows up plainly on the company's books and therefore can be more readily verified than a company's own matching contribution.

(2) Company A spins off company B, which wins a phase I SBIR award. Company A then wants to contribute matching funds to qualify company B for the Fast Track. Can A be considered an outside investor for purposes of the Fast Track?

In making our determination of whether company A is an outside investor, we would be guided by the definition of "affiliates" in 13 C.F.R. Sec. 121.103, discussed above. Our presumption is that in this example A and B would be considered "affiliates," and that A would therefore not be an outside investor for purposes of the Fast Track. However, that presumption could be rebutted by showing, for example, that the spin-off occurred several years ago and that A and B do not exercise control over one another, do not have common ownership or management, have different business interests, etc.

(3) Small company S wins a phase I SBIR award. The president of S is a major shareholder in another company Y, which wants to contribute matching funds to qualify S for the Fast Track. Can Y be considered an outside investor?

Our presumption is that Y would not be considered an outside investor. Our determination would be guided by whether the president's stake in Y is large enough that S and Y would be considered "affiliates" under 13 C.F.R. Sec. 121.103. Subsection c of Section 121.103 specifically discusses affiliation based on stock ownership:

c. Affiliation based on stock ownership.

1. A person is an affiliate of a concern if the person owns or controls, or has the power to control 50 percent or more of its voting stock, or a block of stock which affords control because it is large compared to other outstanding blocks of stock.
2. If two or more persons each owns, controls or has the power to control less than 50 percent of the voting stock of a concern, with minority holdings that are equal or approximately equal in size, but the aggregate of these minority holdings is large as compared with any other stock holding, each such person is presumed to be an affiliate of the concern.

If S and Y are found to be affiliates, we would determine that Y is not an outside investor.

(4) Does the outside investor have to be a single entity (e.g., a single venture capital firm) or can it be more than one entity (e.g., two angel investors and a venture capital firm)?

It can be more than one entity.

(5) Small company A contributes matching funds to small company B in order to qualify B for the Fast Track, and, at the same time, B contributes matching funds to A in order to qualify A for the Fast Track. Do A and B qualify as outside investors under the Fast Track?

No. A and B's relationship is such that their investment in each other would not provide outside validation of the commercial potential of their respective SBIR projects. We would therefore not consider them to be outside investors for purposes of the Fast Track.

(6) Can the brother of an employee of small company S contribute funds to qualify S for the Fast Track?

Probably not. Again, we would be guided by the definition of "affiliates" in 13 C.F.R. Sec. 121.103. The brother presumptively would be an affiliate of company S and not an outside investor.

(7) Venture capital firm V currently is a 22 percent shareholder in small company S. Can V invest additional funds in S to qualify S for the Fast Track?

Our presumption is yes. In making our determination, we would be guided by whether V and S are "affiliates," as defined in 13 C.F.R. Sec. 121.103. Section 121.103 provides (in subsection (b)(5)) that a venture capital firm is not affiliated with a company if the venture capital firm does not control the company -- e.g., by owning more than 50 percent of the stock of a small company (prior to its investment under the Fast Track), as described in 13 C.F.R. 107.865. 13 C.F.R. 107.865 can be viewed on the internet at http://www.acq.osd.mil/sadbu/sbir/affil2.htm.

(8) Large company L makes a cash investment in small company S, and then serves as a subcontractor to S on an SBIR project. Can L's investment in S count as a matching contribution for purposes of the Fast Track?

Only L's cash investment net of its subcontracting effort can count as matching funds for purposes of the Fast Track. For example, if L invests $750,000 in S and subcontracts with S for $250,000, only L's net contribution ($500,000) can count as matching funds for purposes of the Fast Track.

(9) Company Y makes a cash investment in small company S for purposes of the Fast Track, and also enters into a separate contract with S under which Y provides certain goods/services to S in return for $500,000. Can Y's cash investment in S count as a matching contribution for purposes of the Fast Track?

As in the previous example, only Y's cash investment net of the $500,000 it receives from S can count as matching funds for purposes of the Fast Track. However, if the separate contract between Y and S pre-dates S's submission of its phase I SBIR proposal, Y's entire cash investment can count as matching funds for purposes of the Fast Track.

(10) A group of investors wishes to invest funds in small company S to qualify S for the Fast Track. One of the investors is the mother of S's president, who wants to contribute $50,000 toward the effort. Can the group's investment in S count as a matching contribution to qualify S for the Fast Track?

The mother's investment of $50,000 does not count, because she is not an outside investor (see item (6) above). Contributions of the other investors can count provided that they meet the other conditions for the Fast Track (e.g., each must be an outside investor).

B. Examples of What Qualifies as an "Investment"

(1) Can a loan from an outside party qualify as an "investment" for purposes of the Fast Track?

No. The rationale behind the Fast Track is that an outside party is betting on the company's success in bringing the technology to market -- not just its ability to repay a loan.

(2) How about a loan that is convertible to equity?

A loan that is convertible to equity at the company's discretion would count as an investment under the following circumstances: (1) the loan is provided by a public entity (e.g., a state agency), or (2) the loan is provided by a private entity, and the SBIR company actually converts the loan to equity before the end of phase I.

(3) Can in-kind contributions from an outside investor count as matching funds under the Fast Track?

No. The matching contribution must be in cash. A cash contribution is a stronger signal of the outside investor's interest in the technology, and can be readily verified.

(4) Can a purchase order from an outside investor count as a matching contribution under the Fast Track?

An advance purchase order for new products resulting from the SBIR project can count as a matching contribution under the Fast Track (assuming the other Fast Track conditions are met).

(5) Can the funds raised from an initial public offering (IPO) count as matching funds for purposes of the Fast Track?

Yes, as long as the offering memo indicates that a portion of the funds from the IPO will pay for work (e.g., R&D, marketing, etc.) that is related to the SBIR project.

(6) If large company L pays small company S for work related to S's SBIR project and expects a deliverable (goods or services) from S in return, would that qualify as an "investment"?

No, for the same reason a loan does not count. Specifically, in this situation the large company is not betting on the small company's success in bringing the technology to market, but merely on its ability to provide the deliverable.

C. Examples Re: Timing/Logistics of the Fast Track Investment

(1) Can entity E's investment in small company S during the first month of S's phase I SBIR project count as a matching contribution to qualify S for the Fast Track?

Yes, provided that E is an outside investor and that the other Fast Track conditions are met. The investment can occur any time after the start of the phase I project.

(2) Small company A, which has won a phase I award, spins off small company B to commercialize the SBIR technology. A then convinces angel investor I to invest funds in B. Can I's investment in B count as a matching contribution to qualify A for the Fast Track?

For I's investment in B to qualify A for the Fast Track, DoD must determine that A and B are substantially the same entity, as evidenced, for example, by their meeting the definition of "affiliates" in 13 C.F.R. Sec.121.103. If DoD determines that A and B are substantially the same entity, I's investment in B could qualify A for the Fast Track. Of course, the parties must also meet the other conditions for the Fast Track (e.g., I must be an outside investor).

(3) Small company S is collaborating with a university on an STTR project. Investor I wishes to provide funds to the university in order to qualify S for the STTR Fast Track. Can I's investment in the university count as a matching contribution to qualify S for the Fast Track?

In order to qualify S for the STTR Fast Track, I's investment of funds must be in small company S, not in the university. S can then subcontract some of the funds to the university. The rationale is that a cash investment in the small company is a very strong indication of commercial potential, whereas an investment in the university is less so.

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NASA	California Institute of Technology www.jpl.nasa.gov	Jet Propulsion Laboratory 4800 Oak Grove Drive Mail Stop 180-904 Pasadena, CA 91109 Dr. Edward Stone (818) 354-4321
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